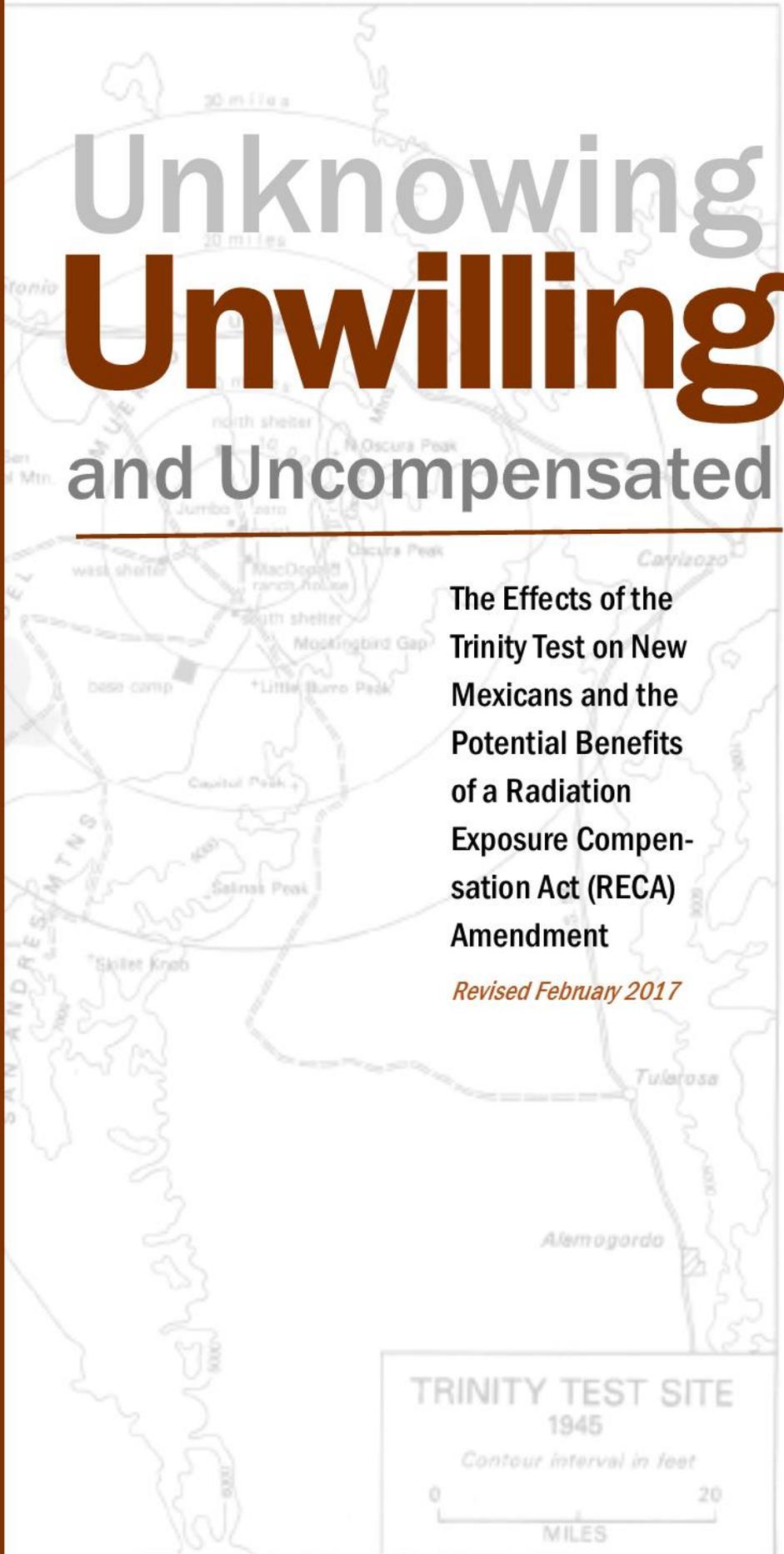




# Unknowing Unwilling and Uncompensated

The Effects of the  
Trinity Test on New  
Mexicans and the  
Potential Benefits  
of a Radiation  
Exposure Compensation  
Act (RECA)  
Amendment

*Revised February 2017*



TRINITY TEST SITE  
1945  
Contour interval in feet  
0 20  
MILES



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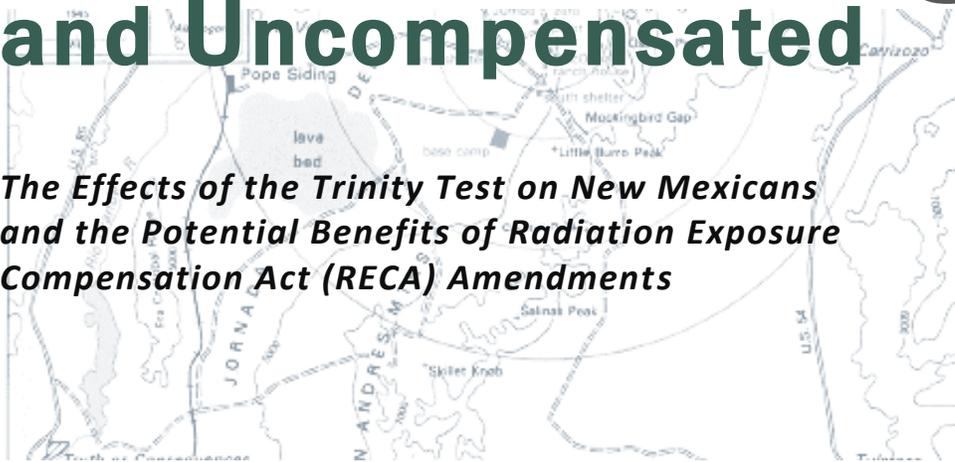
All individuals who participated in focus groups

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*Any opinions expressed in this report are those of the authors and do not necessarily reflect the views of the Santa Fe Community Foundation or the W.K. Kellogg Foundation.*

# Unknowning, Unwilling, and Uncompensated

*The Effects of the Trinity Test on New Mexicans  
and the Potential Benefits of Radiation Exposure  
Compensation Act (RECA) Amendments*



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## List of Acronyms

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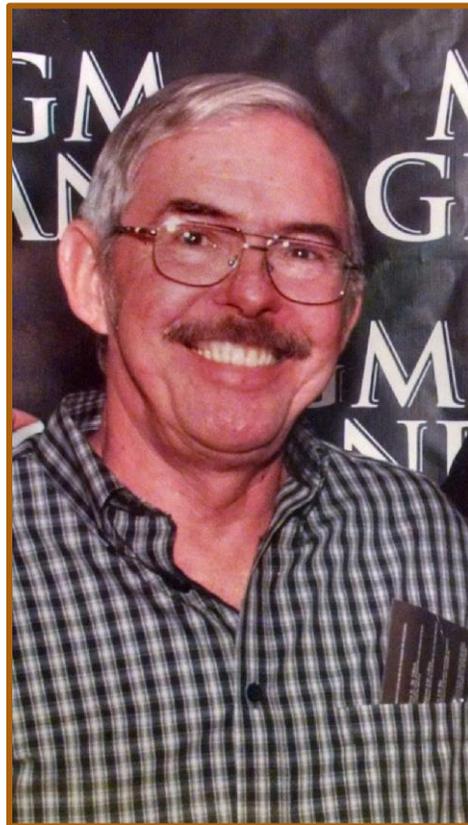
AEC	U.S. Atomic Energy Commission (predecessor to the DOE)
CDC	U.S. Centers for Disease Control and Prevention
DDHS	U.S. Department of Health and Human Services
DOE	U.S. Department of Energy
EEOICPA	Energy Employees Occupational Illness Compensation Program Act
HIA	Health Impact Assessment
ICRP	International Commission on Radiological Protection
IRB	Institutional Review Board
LAHDRA	Los Alamos Historical Document Retrieval and Assessment Project
LANL	Los Alamos National Laboratory
NAS	National Academies of Science
NCI	National Cancer Institute
NM DOH	New Mexico Department of Health
NMHEP	New Mexico Health Equity Partnership
NMTR	New Mexico Tumor Registry
NTS	Nevada Test Site
OMB	U.S. Office of Management and Budget
RECA	Radiation Exposure Compensation Act
TBDC	Tularosa Basin Downwinders Consortium
TSCA	Toxic Substances Control Act
VA	U.S. Department of Veterans Affairs

## Dedication

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The Tularosa Basin Downwinders Consortium (TBDC) and affiliated organizations would like to dedicate this report to the late Fred Tyler. Fred was one of the two original co-founders of the TBDC and a man of great conviction. Fred was dedicated to his family and his community of Tularosa, and he served in many leadership positions. He understood justice and wanted nothing more than to be treated fairly and justly. Fred often said that the test chimps at Holloman Air Force Base had received more attention than the downwinders of New Mexico. Fred fully believed in the mission of the TBDC and was always looking for opportunities to bring attention to health issues faced by the downwinders of New Mexico. He had a true “can-do” spirit and never backed away from the challenging work as a community organizer and advocate on behalf of the TBDC.

We know, that from his place in the heavens, Fred remains with us in spirit and celebrates this HIA and the report.



## Executive Summary

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The Radiation Exposure Compensation Act (RECA) is a federal law originally passed by the United States Congress in 1990 to award financial reparations to Nevada Test Site Downwinders, on-site test participants during atmospheric nuclear weapons tests, and uranium miners and millers who developed cancer and/or other specific illnesses as a result of radioactive fallout or radon gasses to which they were exposed. Trinity test downwinders in New Mexico were not included in the original Act nor were they included in year 2000 amendments to the Act. Residents of southern New Mexico, in particular, have historically experienced high levels of cancer and other illnesses since the 1945 test. Currently proposed amendments to the Act would include the Trinity test downwinders and potentially award them reparations to account for their unknowing and unwilling participation as bystanders to the Trinity test on July 16, 1945, which was the first atmospheric nuclear test ever to occur in the world.

In southern New Mexico, four counties have been primarily affected, as evidenced by high rates of cancer, including rare cancers, and other illnesses, such as thyroid disease. The four counties include Lincoln, Otero, Sierra, and Socorro. Individuals who were at higher risk for developing cancer due to radioactive fallout include, but are not limited to: persons living within 150 miles of the Trinity test site on July 16, 1945; persons who ate game and/or livestock that were exposed to radioactive fallout from the test; persons who drank milk that came from livestock (cows and goats) that were exposed to radioactive fallout; persons who drank water gathered in cisterns that had been poisoned by radioactive fallout; persons who ate food grown in soil that was exposed to radioactive fallout; and descendants of persons from the previous categories whose genetic composition was altered through hereditary DNA changes and/or by consuming or otherwise being exposed to radioactive fallout.

In 2015, New Mexico Representative Ben Ray Lujan (D-NM-3) introduced House of Representatives Bill 994 (HR 994), the “Radiation Exposure Compensation Act Amendments of 2015,” which included the Trinity test downwinders in compensatory efforts. New Mexico Representatives Michelle Lujan Grisham (D-NM-1) and Steve Pearce (R-NM-2) co-sponsored the bill. New Mexico Senators Tom Udall and Martin Heinrich co-sponsored Senate Bill 331 (S. 331), the companion bill in the Senate. The bills had 11

original sponsors and 13 co-sponsors at the end of the 2015-2016 legislative session, a total of 24 Congressional members from across the country supporting its passage.

The Tularosa Basin Downwinders Consortium (TBDC) recognizes that Senators Tom Udall (D-NM) and Martin Heinrich (D-NM) recently introduced [Senate Bill 197 \(S. 197\)](#), “A bill to amend the Radiation Exposure Compensation Act to improve compensation for workers involved in uranium mining, and for other purposes,” for the 2017-2018 legislative session, with Senators from Colorado and Idaho. We understand a companion bill will soon be introduced in the House.

## Health Impact Assessment

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Discussions surrounding the status of RECA since its inception have focused heavily on the financial and economic benefits (and disadvantages) of the Radiation Exposure Compensation Program with the U.S. Department of Justice’s (DOJ) Constitutional and Specialized Tort Litigation section. The value of the Act has not been explored in terms of public health. In Fall 2015, the Tularosa Basin Downwinders Consortium (TBDC) began work with the New Mexico Health Equity Partnership (NMHEP), an initiative of the Santa Fe Community Foundation, to research the impact that an amended RECA would have on the public health of New Mexicans. A Health Impact Assessment (HIA) relies on various data sources, prioritizing stakeholder feedback, to demonstrate how a policy or program, like RECA, would impact the health of the affected communities and makes recommendations to mitigate health risks within the decision-making processes.

## Methodology

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This HIA is informed by data collected during literature reviews, approximately 800 community health surveys, two community focus groups, and existing health data resources. Our recommendations reflect a need to include the Trinity downwinders in the Radiation Exposure Compensation Act (RECA).

## Recommendations

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The HIA findings suggest that amending RECA to include the Trinity downwinders will potentially improve the physical, mental, and generational health of residents in Lincoln, Otero, Sierra, and Socorro Counties in New Mexico. The TBDC supports the provisions for:

- Including New Mexico as a downwind state and an ‘affected area’;
- Medical benefits “in the same manner and to the same extent as an individual eligible to receive medical benefits under section 3629 of the Energy Employees Occupational Illness Compensation Program Act” (EEOICPA); and
- \$150,000 in a lump sum apology payment.

However, the proposed amendments are not sufficient. Recommendations to amend the 2017 Radiation Exposure Compensation Act should include:

- Apologizing to New Mexico residents;
- Removing the 30-day limited eligibility period [June 30, 1945, and ending on July 31, 1945] and creating an open-ended eligibility period for the Trinity downwinders;
- Removing the July 9, 2022, legislative sunset provision and extend the sunset provision to at least July 9, 2045;
- Striking the termination of the RECA Trust Fund in 22 years and extending it until 2045; and
- Providing recurrent annual funding for the RECA Trust Fund.

These recommendations are aimed at Congressional members who have proposed the bills and also who have the potential to amend the bills before they are ratified and can also lobby to pass the legislation. The 2017-2018 Congressional session presents an opportunity to advance the RECA bills with the information and data presented in this report.



## CHAPTER 1: INTRODUCTION

This chapter introduces the reader to the Tularosa Basin Downwinders Consortium; the July 16, 1945, Trinity nuclear bomb test; and the Radiation Exposure Compensation Act (RECA). It explains the framework and process of this Health Impact Assessment, and it also discusses four related studies: the Biological Effects of Ionizing Radiation, Study VII (BEIR-VII); the National Cancer Institute's planned study of the communities surrounding the Trinity site; the Marshall Islanders, where above ground nuclear testing was extensive; and Trevor's Law, with its anticipated implications on communities where cancer clusters exist.

### 1.1 History of the Tularosa Basin Downwinders Consortium (TBDC)

In 2005, Tina Cordova and Fred Tyler, with the help of the local community of volunteers, organized the Tularosa Basin Downwinders Consortium (TBDC). The purpose of this organization is to bring attention to the negative health effects experienced by the people living adjacent to the Trinity test site subsequent to their overexposure to high levels of ionizing radiation that occurred on July 16, 1945, with the explosion of the Trinity atomic bomb test.

For decades, the community has been dealing with higher-than-normal incidences of cancer and death. The organizers hosted numerous town hall style meetings in Tularosa, Socorro, Carrizozo, Albuquerque, and other locations to discuss what the community wanted and needed. In response to the feedback gathered during the town hall meetings, Tina Cordova, co-founder of TBDC, created a health survey, which TBDC began to distribute. To date, approximately 800 completed health surveys have been gathered from residents or former residents of Lincoln, Otero, Sierra, and Socorro Counties and/or their children.

Meanwhile, people in other states, including parts of Nevada, Utah, and Arizona, who were classified as downwinders, were being compensated and given health care benefits through the federal Radiation Exposure Compensation Act (RECA) without having to prove that exposure to radiation from nuclear tests caused their illnesses. It became



apparent that the Trinity downwinders, and New Mexicans in general, for some unknown reason were not provided the same benefits because they were not included in RECA.

The TBDC set out to engage with other organizations that work on issues related to the development and production of nuclear weapons and the disposal of nuclear waste in the State of New Mexico, as well as physicians, interfaith organizations, and university professors. This developed into strategic partnerships and the opportunity to be involved with the team of scientists and researchers that worked on the Centers for Disease Control and Prevention (CDC) Los Alamos Historical Document Retrieval and Assessment (LAHDRA) study. The CDC invited the TBDC to present at a December 2010 meeting at Ohkay Owingeh when the LAHDRA study team released the final LAHDRA study. This interaction proved to be valuable in as much as the LAHDRA study team devoted [Chapter 10 \(“Trinity Test”\)](#) to the Trinity test. In a letter to the Department of Energy (DOE), the CDC developed recommendations to study the radiation levels subsequent to the Trinity nuclear test and the possible effects on the people in adjacent communities.<sup>1</sup> The National Cancer Institute (NCI) is currently working on a three-phase study of the cancer risks associated with exposure to the Trinity nuclear test and intends to conduct interviews and focus groups in various locations throughout New Mexico. The TBDC is watchdogging the process.

---

<sup>1</sup> December 3, 2010, letter from Michael A. McGeehin, Ph.D., M.S.P.H., Director, Division of Environmental Hazards and Health Effects, National Center for Environmental Health, Department of Health and Human Services, to Patricia Worthington, Ph.D., Director, Health Safety and Security, U.S. Department of Energy. Based on the major findings outlined in LAHDRA’s assessment, the following should be considered:

The world’s first test of an atomic bomb was conducted at the Trinity site in south-central New Mexico on July 16, 1945. The National Cancer Institute (NCI) is currently preparing a report on the potential radiation doses to residents of New Mexico as a result of the Trinity test based, in part, on data gathered by LAHDRA. When the NCI report is completed, government officials should meet with interested stakeholders from around the Trinity site to determine if any additional work is warranted at this site. As with all dose reconstruction projects, CDC worked to allow effective input by all stakeholders, including the impacted community. A mechanism should be developed to continue this process should additional work be undertaken as a follow-up to the LAHDRA project.



The organizers of the TBDC knew the only path to attaining RECA compensation and health care benefits for the New Mexico downwinders was through engagement with the New Mexico Congressional delegation, which initially included Senators Pete Domenici (R-NM) and Jeff Bingaman (D-NM), and Representative Bill Richardson (D-NM-3). Eventually the delegation included Senators Tom Udall (D-NM) and Martin Heinrich (D-NM) and Representatives Ben Ray Lujan (D-NM-3), Michelle Lujan Grisham (D-NM-1), and Steve Pearce (R-NM-2). The 2015 RECA amendments were scheduled for hearing in the Senate and House Judiciary Committees, as well as the House Health, Education, and Labor Program (HELP) committee. TBDC members have attended countless meetings with the New Mexico Congressional delegation and their staffers. Through the efforts of the TBDC, a round table discussion with Senator Tom Udall and eight Trinity downwinders occurred on July 1, 2015. Senator Udall is the first federal official to ever return to his home state of New Mexico to listen to the people who suffered the consequences of the first atomic bomb tell their stories. Community and media outlets from around the world attended the event, held at the Tularosa Village Hall, leaving standing room only. That same month, Senator Martin Heinrich met with the TBDC in his Albuquerque office and renewed his commitment to fight for the inclusion of New Mexico in the passage of RECA amendments. The TBDC delivered hundreds of petition signatures to staffers of the Senate and House Judiciary Committees.

The TBDC has an increasingly strong public presence. Local, regional, national, and international television, radio, Internet, and newspaper media have interviewed the organizers of the TBDC and community members from all over New Mexico. The TBDC is exceptionally proud of the fact that what dominated the international news on the 70<sup>th</sup> anniversary of the Trinity test (2015) was not the usual story of the science, industry, and U.S. military exceptionalism but rather the story of the downwinders, which was finally told. The New Mexico downwinders have been featured in stories in the *Wall Street Journal*, *PBS Newshour*, *Al Jazeera*, mainstream Japanese media, all the local TV stations, and most of the state's newspapers, along with the Associated Press, whose stories have been picked up all over the world.<sup>2</sup> A film documentary entitled [Fallout – Before](#)

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<sup>2</sup> The AP story entitled "70th Anniversary a Source of Pride, Anger" was picked up by national and international news outlets, including but not limited to: *News OK* (Oklahoma); *ABC News*; *San Francisco Gate*; *The Columbus Dispatch* (OH); *Knoxville News Sentinel*; *CDA Press* (Coeur D'Alene, ID); *Seattle Times*



[Hiroshima There Was New Mexico](#) is currently being produced. Members of the TBDC are often asked to speak at events and frequently participate in middle school, high school, and college-level class lectures and presentations. TBDC has made presentations to the New Mexico State Legislature and national grassroots organizations such as the Alliance for Nuclear Accountability (ANA). The TBDC welcomes any opportunity to engage the public in discussions about the issues facing the New Mexico downwinders. The TBDC can be contacted via our [website](#).

The TBDC is dedicated to continuing three annual events, including 1) the candlelight vigil commemorating the Trinity test held each July, 2) a peaceful demonstration held in April, and 3) another peaceful demonstration held in October at the Stallion Gate of the Trinity site when the site opens to the public.



**Figure 1. The Seventh Annual Tularosa Candlelight Vigil at the Tularosa Little League Field on July 16, 2016**

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(WA); Phys.org (physicists news journal); *Myrtle Beach Online* (SC); *Salt Lake Tribune* (UT); *The Columbian* (WA); *Houston Chronicle* (TX); *Daily Herald* (Chicago, IL); KXAN (Austin, TX); Beaumontenterprise.com (TX); Knoxblogs (Knoxville, TN); Newser.com; WTOP (Washington D.C., MD and VA); KRON 4 TV (Bay Area, CA); San Diego News (Union, CA); Alamogordo News (NM); Japan Times; WBTV (Charlotte, NC); YAHOO! News; WNCT (Greenville, NC); Fox21 News; WKRK (Mobile, AL); CNS News; WRAL (Raleigh, NC); WBT news radio; The Economic Times of India; Gulf News- Persian Gulf/Middle East; CTV News (Canada); Today Online (Singapore); Virgin Island Daily News; Detroit News (MI); Erie Times (PA); Tri-City Herald (WA); WSVN News (Miami, FL); Financial Express; Southeast Missourian (MO); KOLO-8 News (Reno/LV, NV); Las Cruces, NM; Wyoming Tribune-Eagle News (Cheyenne, WY); Salon.com; Merced Sun-Star (CA); Daily Star (Oneonta, NY); Herald-Star (Mobile, AL); Star Tribune (MPLS, MN); Kansas City Star (KS); Post-Star (Glenns Falls, NY); NY Times; Washington Post; US News and World Report; Colorado Springs News (CO); Times Union; Norfolk Daily News (VA); The Daily Astorian (Pacific OR); Deseret News (UT); KDH News (Killeen, TX); Cache Valley Daily (Logan, UT); Riverbender.com (ID); and Gillette News Record (WY).



The annual candlelight vigil is held in Tularosa where the community comes together to memorialize the people they have lost to cancer and other illnesses related to radiation exposure. This occurs on the Saturday closest to July 16<sup>th</sup> each year. During the Seventh Annual Candlelight Vigil in 2016, over 800 luminarias were lit in memory of community members who died of cancer or other diseases resulting from radiation exposure. On one day in April and again in October, the Federal Government briefly opens the Trinity site to visitors wanting to observe the actual bomb blast site. TBDC organizes demonstrations at both Stallion Gate and Tularosa Gate entrances to the Trinity site in order to peacefully protest the damaging effects of the Trinity atomic bomb on New Mexicans.

## 1.2 History of the July 16, 1945, Trinity Test

On Monday, July 16, 1945, the U.S. Federal Government secretly exploded a plutonium bomb called the Gadget in south central New Mexico during the Trinity test as part of the



Figure 2. TBDC members are interviewed by KOAT-TV Channel 7 news during the April 2, 2016, demonstration at the Stallion Gate entrance to the Trinity site.



World War II Manhattan Project. The government described the area as “remote and uninhabited.” In reality, there were more than 40,000 people living in the four counties including communities surrounding the Trinity site. (See Figure 3.)

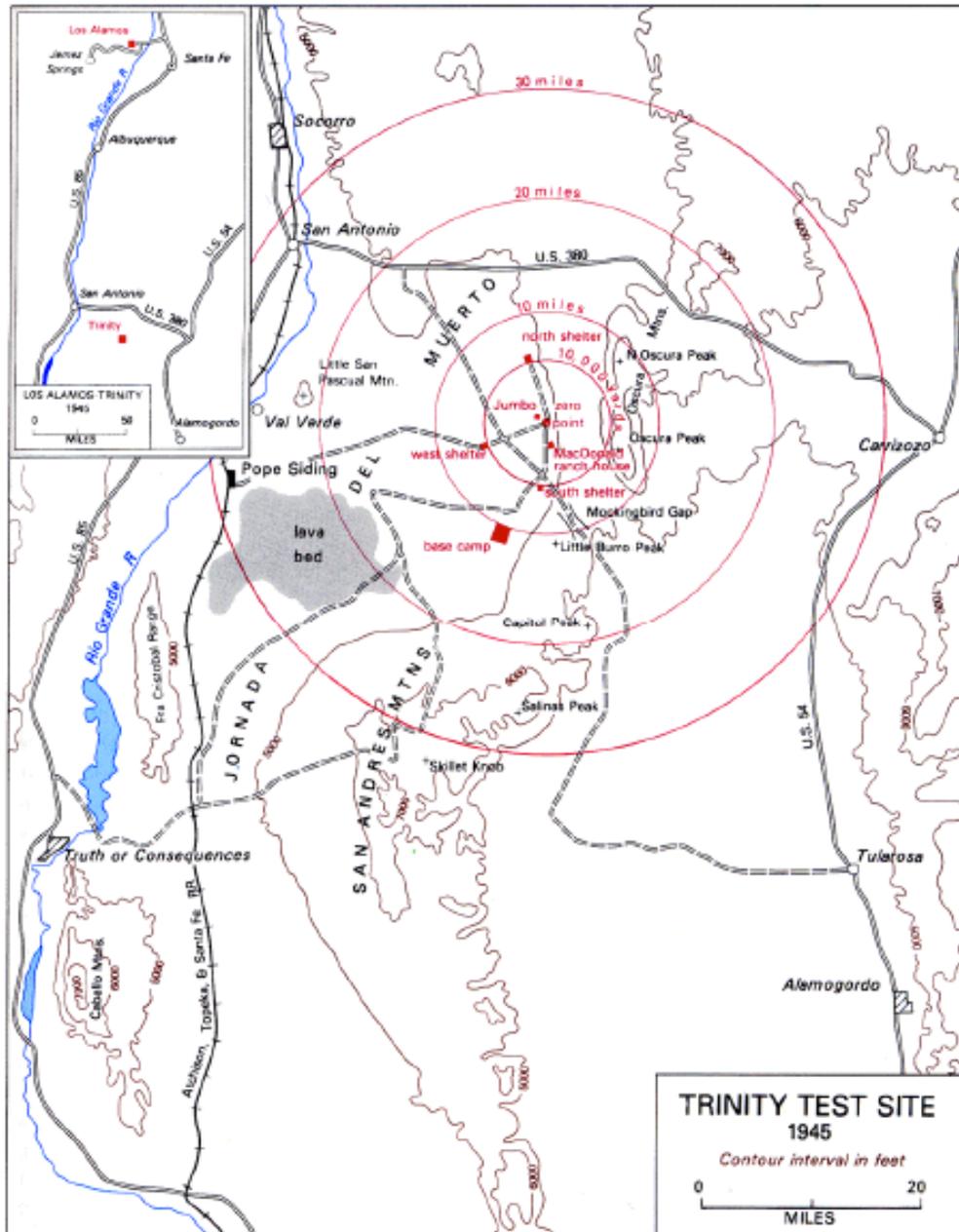


Figure 3. “Location of the Trinity Test Site and Nearby Towns” from CDC’s LAHDRA Project



The test was scheduled for 4:00AM, but the blast was delayed for approximately an hour and a half because of rain and occasional flashes of lightning. The first-ever plutonium bomb, the Gadget, was exploded at 5:29AM Mountain War Time. The light from the blast was observed across the entire state of New Mexico and in parts of Arizona, Texas, and Mexico. Intense heat was felt from 10 miles away and described as “like standing directly in front of a roaring fireplace” (“Trinity Test” 232). Bright, yellow light from the blast was viewed from Albuquerque and Los Alamos to the north, Silver City to the west, and El Paso, Texas, to the south (“Trinity Test” 232). According to the LAHDRA report:

In retrospect, pioneer health physicist J. Newell Stannard identified two main gaps in the description of Trinity event (Stannard 1988). The first deals with the characterization of residual plutonium, which was present due to the fact that the efficiency of the device was not 100 percent. The Trinity “Gadget” contained 6 [kilogram] kg of  $^{239}\text{Pu}$  as its sole fissile material (USDOE 2001). The 21 [kiloton] kt yield of the blast (USDOE) corresponds, at  $1.45 \times 10^{23}$  fissions per kt (Glasstone and Dolan 1977), to  $3.05 \times 10^{24}$  atoms or 1.21 kg of  $^{239}\text{Pu}$  fissioned. That indicates that approximately 4.8 kg of  $^{239}\text{Pu}$  remained unfissioned and was dispersed in the environment. It was present in the crater and partly scattered around the environment in the fallout. Monitors did find some plutonium—it was not measured very carefully near shot time, but its presence was hinted at in the initial surveys (Stannard 1988). The instruments used by field monitoring teams were acknowledged to be incapable of measuring alpha contamination in the environment to the desired sensitivities (Hoffman 1947). A full-scale survey of the Trinity site was not conducted until three years later, by that group from the UCLA medical school. (“Trinity Test” 254)

Fission is the only reaction that produces highly radioactive byproducts. The inefficiency of the Gadget yielded 4.8 kg of unfissioned plutonium that was released into the atmosphere. Approximately 76% of the plutonium was dispersed into the atmosphere yielding approximately a 24% efficiency rate. This is an important fact that is often neglected in the telling and re-telling of the Trinity test. The TBDC now brings our claim that the Trinity test impacted the health of residents and their descendants living in Lincoln, Otero, Sierra, and Socorro counties— as well as other New Mexico residents— to the forefront of conversations about the Trinity test. We want to convey the fact that one millionth of a gram of plutonium inhaled or ingested into the body will cause cancer.

Fallout from the test was measured beginning immediately after the blast. Colonel Stafford Warren, Chief of the Manhattan Project’s Medical Section, stated in a report to General Leslie Groves, military head of the Manhattan Project, in a letter on Saturday, July 21, 1945: “By 0800 hours the monitors reported an area of high intensity in a canyon



20 miles northeast of [ground] zero... Intensities in the deserted canyon were high enough to cause serious physiological effects” (Warren qtd. in “Trinity Test” 235). He went on to report that “[T]he distribution over the countryside was spotty and subject to local winds and contour. It skipped the nearby highway #380 (20 mi. N.E.) except for low intensities, which were equaled at twice and three times the distance. It is presumed that the largest outfall occurred in the N.E. quadrant of the site. This can only be explored by horseback at a later date” (Warren qtd. in “Trinity Test” 235). The cloud dropped fission products across a region measuring 100 miles long and 30 miles wide (“Trinity Test” 236; See Figure 4). Locals reported a white substance that some characterized as ash-like or flour-like that settled for up to five days following the blast. Remnants from the blast were detected in Indiana, Kansas, Iowa, upstate New York, and New England (“Trinity Test” 236).

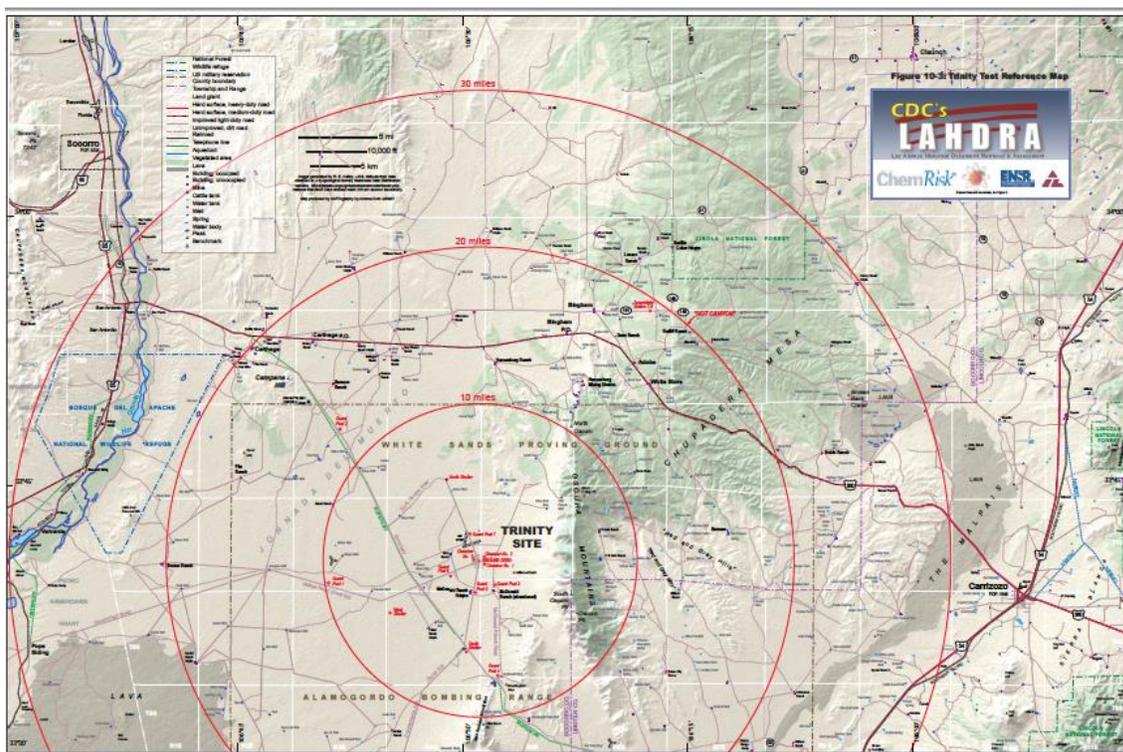


Figure 4. “Trinity Test Reference Map” from CDC’s LAHDRA Project

According to the LAHDRA Project, there are eight (8) ways that the public might have been exposed to radiation and radioactive materials from the July 16, 1945 blast (“Trinity Test” 241):

1. Direct, prompt radiation from the blast itself



2. Direct, external irradiation from the cloud passing overhead nearby
3. Direct, external irradiation from being immersed in the cloud
4. Direct, external irradiation from contamination deposited on the ground
5. Direct, external irradiation from contamination deposited on the skin, hair, or clothing
6. Internal dose from inhalation of airborne contamination
7. Internal dose from inhalation of resuspended fallout particles
8. Internal dose from ingestion of contaminated food products

Dr. Louis Hempelmann, the medical doctor who oversaw the Trinity test, informed Kenneth Bainbridge, Director of the Trinity test, that a total dose of 68 Rem over a two weeks span “would certainly not result in permanent injury to a person with no previous exposure...It would probably not even cause radiation sickness. A normal person could probably stand two to three times this amount without sustaining permanent bodily damage. Fatalities would not result unless two more times this dose were delivered” (qtd. in “Trinity Test” 243). In fact, they set the “upper limit of integrated gamma ray dose for the entire body over a period of two weeks (336 hours) as 75 roentgens” (“Trinity Test” 244). Rem is the unit of radiation dosage applied to humans. Today a rem is defined as the dosage in rads that will cause the same amount of biological injury as one rad of X-rays or gamma rays.

None of the medical personnel had considered the long-term effects of ionizing radiation overexposure. Except for residents of the Ratliff ranch,<sup>3</sup> local residents were not monitored or tested at any point after the blast; only cattle were tested for effects of being overexposed. Naomi Jaramillo Steele recalls a government truck retrieving their cattle from their ranch in Bingham and from neighboring ranches. She was five years old at the time of the Trinity explosion and remembers that the blast shattered their

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<sup>3</sup> The Ratliff ranch was located about one mile east of “Hot Canyon,” where the highest readings had been taken after the blast. An elderly couple lived in an adobe house with a young grandson, several dogs, and assorted livestock, including 200 goats and some turkeys and donkeys (“Trinity Test” 246, 257). The ranch had been overlooked and was discovered after the blast during monitoring. The Ratliff ranch residents were observed periodically for two years after the Trinity test, but the reasons for the government’s doctors’ visits were never disclosed (“Trinity Test” 251).



windows (Gutierrez interview). Her father, Juan Jaramillo, raised calves to feed the family. Two of his cows turned completely white. The government did not take the white cows for reasons unknown. The white cows never reproduced again and subsequently died.

However, gamma ray measurements on July 16 and 17, 1945, reveal high roentgen readings. With the monitoring device in Carrizozo, for example, at about 3:45PM on July 16, the meter went off scale. Full scale on that recorder, which was set to the least sensitive scale, corresponded to 10,000 counts per minute. An hour later, the meter indicated an intensity of 1.5 millirem<sup>4</sup> per hour, which lasted until the following morning. Still, levels in the surrounding areas were so high that officials considered evacuating some towns, including Bingham, Carrizozo, and Vaughn, but the government ultimately did not evacuate any residents (“Trinity Test” 247-50; See Figure 5). Dr. Hempelmann later stated that “a few people were probably overexposed, but they couldn’t prove it and we couldn’t prove it. So we just assumed we got away with it” (Hempelmann and Henrickson).

Thus, the doctor who was in charge of the Trinity test medical team admitted that evidence of overexposure of residents was only lacking because it was not collected. This was an intentional omission on behalf of the Trinity test medical team, the Manhattan Project team, and the U.S. government, which did not want undue public attention focused on the huge blast and its aftermath. Ultimately, as the LAHDRA report confirms:

All evaluations of public exposures from the Trinity blast that have been published to date have been incomplete in that they have not reflected the internal doses that were received by residents from intakes of airborne radioactivity and contaminated water and foods. Some unique characteristics of the Trinity event amplified the significance of those omissions. Because the Gadget was detonated so close to the ground, members of the public lived less than 20 mi downwind and were not relocated, terrain features and wind patterns caused ‘hot spots’ of radioactive fallout, and lifestyles of local ranchers led to intakes of radioactivity via consumption of water, milk, and homegrown vegetables, it appears that internal radiation doses could have posed significant health risks for individuals exposed after the blast. (“Trinity Test” 254)

As further evidence of the government’s intentional neglect for human monitoring, General Groves, military director of the Manhattan Project, stated that the future site for

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<sup>4</sup> A millirem is 1,000<sup>th</sup> of a Rem.



further atomic testing be “preferably with a radius of at least 150 miles without population,” unlike the 15-mile radius to residents at Trinity.

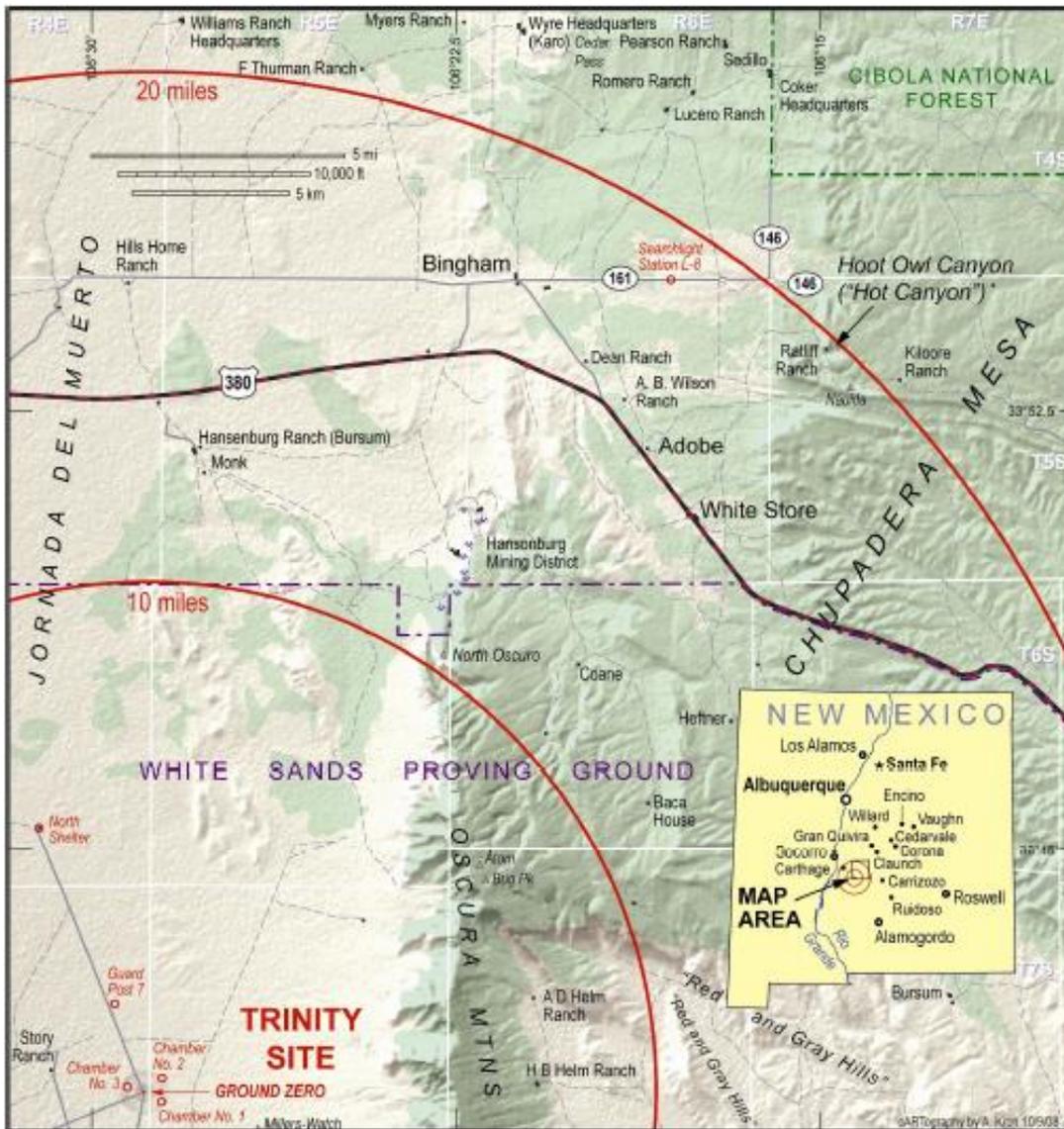


Figure 5. “Map of the Areas to the Northeast of the Trinity Site Where Highest Offsite Radiation Levels Were Measured After the July 1945 Shot” (LAHDRA 10-20)



### 1.2.1 Comparison of Trinity Test to Atmospheric Tests at the Nevada Test Site

A factual discussion of Trinity fails to convey the levels of radioactive fallout New Mexicans encountered. The Gadget was an inefficient device that used only a small fraction (about 24%) of the plutonium core. The Gadget was detonated at a lower height (100 ft) than atmospheric tests conducted at the Nevada Test Site (NTS).<sup>5</sup> This low height of bomb detonation greatly increased the quantity of radioactive soil and pulverized rock debris swept up and suspended in the atmosphere along with the radioactive fallout directly from the device itself, including plutonium, cesium, americium, and other dangerous radioisotopes as compared to fallout from operations at the Nevada Test Site. The downwind population in New Mexico not only received Trinity fallout but also fallout from NTS nuclear weapons testing.

Downwind of Trinity, cattle located on ranch land on the Chupadera Mesa (~20 miles away) had the skin burned off of their backs from heavy fallout. Skin dose estimates from beta radiation in fallout to those cattle ranged up to 50,000,000 millirem. There has been no estimate of dose to the skin or to the lens of the eye of nearby residents, such as the ranchers who presumably lived near their cattle operation. The Manhattan Project was forced to buy those radiated cattle and dispose of them to avoid adverse publicity. The International Commission on Radiological Protection (ICRP) recommends a limit for the public that is 10,000 times lower for the lens of the eye to avoid cataracts, with a similar value (i.e. 10,000 times lower) for skin dose to avoid melanoma. No researcher can confidently argue that exposures well in excess of ICRP recommendations did not occur (i.e. 10,000 times lower than the cattle). There were significantly lower exposures downwind of the NTS because those atmospheric tests were conducted at much higher heights. The devices tested essentially used nearly all of the fissile material, such as plutonium, and the downwind population (including any cattle) were located more than 10 times as far from the test as was the population surrounding Trinity. The AEC never had to buy cattle downwind of NTS because none had the skin burned off of their back.

Scientists from Los Alamos—Site Y of the Manhattan Project, which later evolved into the Los Alamos Scientific Laboratory and then the current Los Alamos National Laboratory—

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<sup>5</sup> In 1955, a series of tests shot off of 300- to 500-foot towers were conducted during Operation Teapot at the Nevada Proving Ground.



were concerned about health effects to members of the public from the Trinity test and later traveled back to the area to casually observe families who they felt were the most likely to have been highly exposed. However, they simply observed the people and did not conduct medical tests. In contrast with Trinity, at no time did the U.S. Atomic Energy Commission (AEC) scientists feel there was a need to check up on the health of downwinders exposed during active atmospheric testing at NTS.

The Trinity project positioned various "Searchlight" stations to provide a light for photographing the overhead plume. Searchlight crew L-8 was located just east of the town of Bingham. When fallout began to cover that area immediately after the blast, the crew buried food they were grilling and evacuated because of the radiation levels. No effort was made to alert the residents of the towns of Bingham, Adobe, or White Store or other nearby ranches, such as the Ratliff Ranch. (See Figure 5.)

An atomic bomb detonated close to the earth, as was the case with the Trinity bomb, exhibits a "skip" distance in which little fallout is found close by. This phenomenon was unknown at the time of the Trinity test and contributed to an improper judgment that the fallout would remain airborne. The Manhattan Project team also had estimated the plume would never touch down. As the monitoring teams went downwind following the plume, radio contact with the base became limited. However, this was the area where fallout began to cover the ground, and the decision makers were not completely aware of the fact that their own criteria for evacuating the local population had been exceeded. The operation was terminated prematurely based on that faulty information. Because of the height of the tests, and the distance to offsite populations, no such precautions were needed for the NTS.

The location of many ranches and towns in the Trinity test fallout area provided a unique pathway for radioactive exposure to the public, including that of cisterns and other uncovered water sources such as ponds, streams, and ditches used for potable drinking water for humans and livestock. Rain followed the blast and its fallout, resulting in contamination being washed from the metal roofs into cisterns used for potable water at local ranches, as well as increasing the fallout load in local ponds and catchments used for the water supplies in nearby towns. This type of exposure pathway is called 'internal dose,' which results from drinking water, ingesting food, or inhaling air contaminated by



fallout. Internal doses of radiation, in the form of neutrons, which can produce orders of magnitude greater harm on health than external doses, has never been measured or characterized for Trinity's downwinders by any federal agency to date.<sup>6</sup>

### 1.3 History of the Radiation Exposure Compensation Act (RECA)

The United States Department of Justice (DOJ) describes the Radiation Exposure Compensation Act (RECA) as “an administrative program for claims relating to atmospheric nuclear testing and claims relating to uranium industry employment” (“Radiation Exposure Compensation Act”). The Act “delegated authority to the Attorney General to establish procedures and make determinations regarding whether claims satisfy statutory eligibility criteria” (Ibid.). This program allows for partial restitution to individuals who developed serious illnesses after exposure to radiation during one or more of the nation's atmospheric nuclear tests or after employment in the uranium mining industry and provides health care coverage. The Act was passed on October 5, 1990, and its scope of coverage was broadened in 2000.

The legislation was amended on July 10, 2000. The revised law is known as the “Radiation Exposure Compensation Act Amendments of 2000,” Public Law 106-245, 106<sup>th</sup> Congress. The amended Act, Sec. 2, “Findings,” states:

[A] congressional [sic] oversight hearing conducted by the Committee on Labor and Human Resources of the Senate demonstrated that since enactment of the Radiation Exposure Compensation Act (42 U.S.C. § 2210 note), regulatory burdens have made it too difficult for some deserving individuals to be fairly and efficiently compensated. (“Amendments of 2000”)

Interestingly, that oversight hearing did not address the exclusion of downwinders in New Mexico. It did, however, give attention to uranium millers and miners in New Mexico.

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<sup>6</sup> The final LAHDRA report states: “It is important to note that all assessments of exposure from the Trinity test issued to date are based on monitoring data and have not addressed internal doses received after intake of radioactivity through inhaling or consuming contaminated water or food. Moreover, these assessments have not been subjected to the rigorous quality control processes used in modern dose reconstruction studies that include data validation, application of appropriate data adjustments/correction factors, and uncertainty analysis.” (LAHDRA 21-A2)



Further, Section 3, pertaining to “Claims Relating to Atmospheric Nuclear Testing” was amended for claims relating to leukemia. The Amendment considers a compensation-eligible person one who:

was physically present in an affected area for a period of at least 1 year during the period beginning on January 21, 1951, and ending on October 31, 1958 [as a bystander]; was physically present in the affected area for the period beginning on June 30, 1962, and ending on July 31, 1962 [as a bystander]; or participated onsite in a test involving the atmospheric detonation of a nuclear device; and submits written documentation that such individual developed leukemia—after the applicable period of physical presence described [in the earlier section]” or “more than two years after the first exposure to fallout.” (“Amendments of 2000”)

This year 2000 amendment made the bystander eligible for \$50,000, and an onsite participant eligible for \$75,000 (“Amendments of 2000”). Additionally, the conditions were amended so that “Initial exposure occurred prior to age 21.”

The year 2000 amendments resulted in an increased amount of claims, and the United States Government Accounting Office (GAO) reported in April 2003 that the number of claims increased 92 percent (“GAO Report” 2). In 2000, the number of claims filed was 7,819 through the end of the fiscal year, and 14,987 claims had been filed by the end of the fiscal year 2002 (“GAO Report” 2). This resulted in claims taking longer to process. The downwinder states included parts of Nevada, parts of Utah, and parts of Arizona; New Mexico was still not included as a downwinder state. The 21<sup>st</sup> Century Department of Justice Appropriations Authorization Act was enacted on November 2, 2002, further amending RECA. One of the major changes included the re-insertion of a downwinder area (not including New Mexico) that was inadvertently eliminated when RECA was amended in July 2000 (“GAO Report” 6).

Military and Manhattan Project employees who were onsite participants in the Trinity test who became ill are eligible for compensation of \$75,000, but the Trinity test downwinders were never acknowledged and remain ineligible for compensation of any kind. For the past seven years, Senator Tom Udall (D-NM), Senator Martin Heinrich (D-NM), Representative Ben Ray Lujan (D-NM-3), and others have introduced amendments to RECA to include New Mexico downwinders in the compensation program. Each year, more Congressional cosigners join to support passage of the amendments. Nevertheless, key Congressional committees have yet to schedule hearings on the proposed



amendments. It is the goal of the TBDC, Concerned Citizens for Nuclear Safety (CCNS), Interfaith Worker Justice of New Mexico (IWJ-NM), and Physicians for Social Responsibility (PSR) to utilize the data collected through the Health Impact Assessment (HIA) to educate decision makers on why New Mexico should be included in the RECA downwinders program.

The DOJ established the Radiation Exposure Compensation Program in 1992. Since then, over 43,804 claims have been filed. Over \$2.07 billion has been awarded. Over 31,415 claims have been approved (as of December 2015) (“FY 2017 Budget”). The “Radiation Exposure Compensation Act Trust Fund FY 2017 Budget and Performance Plan” prepared by the U.S. Department of Justice estimates that “approximately \$70 million will be needed for the RECA Trust Fund in FY 2017” (“FY 2017 Budget”). This estimate does not anticipate the inclusion of the Trinity test downwinders.

### **1.3.1 Diseases Covered by the Radiation Exposure Compensation Act (RECA)**

It is important to name the diseases followed by RECA, many of which appear in our data gathered for this HIA report. Currently, RECA covers the following diseases:

Leukemia (other than chronic lymphocytic leukemia), provided that initial exposure occurred after the age of 20 and the onset of the disease was at least 2 years after first exposure, and the following diseases, provided onset was at least 5 years after first exposure: multiple myeloma, lymphomas (other than Hodgkin’s disease) and primary cancer of the: thyroid, male or female breast, esophagus, stomach, pharynx, small intestine, pancreas, bile ducts, gall bladder, salivary gland, urinary bladder, brain, colon, ovary, liver (except if cirrhosis or hepatitis B is indicated), or lung. (Sec. 4(b)(2))

## **1.4 Purpose and Focus of This Health Impact Assessment (HIA)**

The federal government has never formally admitted any wrongdoing to the communities surrounding the Trinity site for over 70 years. This study presents evidence of community frustrations, fears, and health conditions that warrant further health studies in Lincoln, Otero, Sierra, and Socorro counties. The purpose of this HIA is to analyze the long-term health consequences of the Trinity nuclear test from 1945 and consider the ways that the passage of Radiation Exposure Compensation Act (RECA) amendments could positively affect the health of the communities in the Tularosa Basin and across New Mexico. There are three primary health determinants. They are:



1. Lack of access to healthcare,
2. Economic impact(s) to patients and families, and
3. Generational trauma

This Health Impact Assessment examines the effects of the Trinity test on residents of the Tularosa Basin and their families. No major health study has ever been conducted on the people living downwind and downstream of the world's first atmospheric nuclear test. Thus, this HIA culls and compiles information relevant to physical, mental, generational, and economic health and status of these communities that have been historically ignored. New Mexico Congressional representatives are dedicating an increasing amount of attention to the Trinity downwinders as evidenced by their proposed amendments to RECA. This report attempts to provide evidence and analysis to support the passage of such amendments that would include New Mexico residents (former and current) as downwinders in the United States history of atmospheric nuclear testing. The TBDC is concerned with making the government more aware of the lasting effects of the Trinity test and awarding reparations vis-à-vis monetary compensation and provision of adequate healthcare to the individuals and their families who have suffered due to the July 16, 1945, release of radiation.

The primary stakeholders involved in this study include former and current residents of the Tularosa Basin and the counties of Lincoln, Otero, Sierra, and Socorro. The goal of this study is to 1) examine the physical, mental, and generational health concerns and conditions as well as the economic impact that these effects have on New Mexico's affected communities and 2) predict how these communities might be positively affected by the passage of RECA amendments. Placing the stories of community members at the forefront of such research creates a significantly different story than the historical narrative of a deserted and uninhabited region surrounding the bombsite. These stories supplant older narratives to provide key decision makers with accurate, current information to aid in the Congressional decision-making process.

## **1.5 Concurrent Studies**

Four concurrent studies that we believe may affect whether or not the U.S. Congress ultimately amends RECA include the National Academies of Sciences Biological Effects of Ionizing Radiation VII (BEIR VII); the Centers for Disease Control and Prevention (CDC) Los



Alamos Historical Document and Retrieval and Assessment (LAHDRA) Project; the National Cancer Institute “Study to Estimate Radiation Doses and Cancer Risk from Radioactive Fallout from the Trinity Nuclear Test”; concurrent studies in the Marshall Islands; and the recently passed Trevor’s Law, federal legislation as part of the amendments to the Toxic Substances and Control Act (TSCA).

### **1.5.1 Effects of Ionizing Radiation VII (BEIR VII)**

In July 2005, the National Academies of Sciences (NAS)<sup>7</sup> released a report on radiation risk called the [BEIR VII report](#), which presents major implications about how radiation protection regulations are developed and enforced. “BEIR” stands for the Biological Effects of Ionizing Radiation. The 2005 NAS report was an update to the [BEIR V report](#), which was issued in 1990.

The BEIR VII Committee states that, “Ionizing radiation – the sort found in X-rays or gamma rays – is defined as radiation that has sufficient energy to displace electrons from molecules. Free electrons, in turn, can damage human cells” (“Public Summary”). BEIR VII focuses on the health effects of low levels of low linear energy transfer (LET) ionizing radiation and estimates risks for cancer incident rates as well as mortality.

Most significantly, the 1990 BEIR V report estimated about a five percent higher mortality risk for women than for men of dying from cancer. BEIR VII reports a 37.5 percent higher risk of cancer mortality for women. The risk estimates for men are higher for a few specific cancers, including leukemia, but for solid tumors, the cancer risk incidence rate for women is about double that for men.

The risk for children is greater. For example, “the same radiation in the first year of life for boys produces three to four times the cancer risk as exposure between the ages of 20 and

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<sup>7</sup> The National Academies of Sciences (NAS) is a non-profit, non-governmental organization chartered by the U.S. Congress in 1863 at the request of President Lincoln and serves the country with independent, expert advice. When asked to review a scientific task, the NAS gathers together a committee of experts, which is balanced to represent various points of views.



50. Female infants have almost double the risk as male infants.” See Table [12-1](#) in the report.

### **1.5.2 Continuation of Centers for Disease Control and Prevention (CDC) Los Alamos Historical Document Retrieval and Assessment (LAHDRA) Project**

The Centers for Disease Control and Prevention (CDC) LAHDRA recommendations prioritized work on the Trinity test. In a December 3, 2010, letter from the CDC to the Department of Energy, they state: “Nearby residents were not warned before the 1945 Trinity blast or informed of health hazards afterward, and no residents were evacuated” (“Letter from CDC to DOE”). They also recommended additional work at Los Alamos National Laboratory (LANL) regarding the releases of airborne plutonium, as well as five additional radionuclides and chemicals (beryllium, tritium, uranium, iodine, and mixed fission products). The TBDC supports the LAHDRA recommendations and the continuation of the LAHDRA Project to address releases from the Trinity test and LANL. LAHDRA’s 2010 recommendations to the CDC included procuring adequate federal funds to initiate long-awaited ‘cause and effect’ epidemiology studies for New Mexico downwinders. To date, this has not occurred. Further, correspondence between TBDC and NCI has indicated that NCI will not undertake epidemiology work during its current Trinity radiation study. TBDC believes this omission is a major oversight that needs correction.

### **1.5.3 National Cancer Institute “Study to Estimate Radiation Doses and Cancer Risk from Radioactive Fallout from the Trinity Nuclear Test”**

As noted in a December 3, 2010, CDC letter to the DOE, the NCI “is currently preparing a report on the potential radiation doses to residents of New Mexico as a result of the Trinity test based, in part, on data gathered by LAHDRA.”<sup>8</sup>

On October 29, 2007, Senator Jeff Bingaman (D-NM) wrote to the U.S. Department of Health and Human Services (DHHS), the umbrella agency that includes NCI, asking for the “cost and time required to analyze cancers related to the 1945 Trinity nuclear test in New

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<sup>8</sup> The final LAHDRA report states that, “An epidemiological study is currently being performed by the National Cancer Institute (NCI), and is slated to be released in 2011” (LAHDRA 21-A-1). To date, this study has not been completed.



Mexico” (“Bingaman Letter”). On February 21, 2008, the Department of Health and Human Services replied with a cover letter and two “draft”/“not for citation”<sup>9</sup> reports: an executive summary entitled “Trinity Nuclear Weapon Test: Estimates of Radiation Doses to the Residents of New Mexico” and a technical report entitled “Trinity Nuclear Weapon Test: Estimates of Radiation Doses to the Residents of New Mexico.” The cover letter explained, “NCI has provided rough dose estimates to the thyroid [Iodine-131 exposure] and to red bone marrow [Strontium-90 exposure] of representative individuals assumed to have resided in any of the ranches, farms, camps, and towns located within 30 miles of Trinity site ground zero as well as in other towns of New Mexico.”

NCI summarized its findings in the technical report.

Estimated radiation exposure rates and external and internal radiation doses to the thyroid and bone marrow were calculated for populations residing in the 19 counties in New Mexico who were exposed to fallout from the Trinity nuclear test explosion at the Alamogordo Bombing Range in Socorro County in July 1945. Radiation doses were also estimated for residents in 94 sub-regions, main cities and towns in these counties. Radiation doses were estimated for representative persons in each of the counties and geographic sub-regions based on key radionuclides produced from the nuclear test. Doses were separately estimated for residents in wooden houses and residents in adobe or stone houses. Thyroid doses from internal radiation were calculated based on the consumption of contaminated milk. Because of sensitivity of the thyroid to radiation exposure varies notably with age, doses were estimated for six age categories including newborn, children of 1, 5, 10, and 15 years of age, and adults.

The mean doses received by the thyroid and bone marrow from external irradiation for people living in wooden houses were estimated to range from 0.1 mGy for in Rio Arriba, Union, Sandoval, Los Alamos, Harding, and Quay counties to more than 10 mGy in Torrance, Guadalupe and Socorro counties. Doses for people living in adobe houses were estimated to be half of these estimates. Estimated thyroid doses from internal irradiation varied with age and were the highest for people who were one year old at the time of the detonation. For one-year old infants, estimated mean thyroid doses ranged from about 1 mGy in Rio Arriba, Harding, and Quay counties to about 600 mGy in Torrance and Guadalupe counties. There were large variations, up to an order of magnitude, in estimated doses from external as well as internal irradiation by location within counties. (“Technical Report” 6)

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<sup>9</sup> We never received a final document.



In August 2013, at the recommendation of ChemRisk (the LAHDRA contractor), NCI contacted Tina Cordova and Fred Tyler of TBDC, as well as Concerned Citizens for Nuclear Safety, as two of several local, non-government organizations, to discuss the Trinity test and their planned work to conduct a study on diet and lifeways of people living in the Tularosa Basin during and after the July 16, 1945, nuclear atmospheric test. The unofficial executive summary and technical draft referenced above, of which we never received a final report, contained unclear and untraceable calculations about the Trinity test releases; it was considered secret. The TBDC was insistent that NCI/CDC release the report to the public.

In 2014, the NCI engaged with the TBDC and other organizations around developing the Phase I protocol and study questions to be utilized when meeting with study participants. Many times, members of the TBDC asked to have some influence over the study questions and were assured by the NCI that experts in the area of diet and nutrition at the NCI were working on the questions for the study and were not in need of TBDC's assistance. When NCI finally presented the TBDC with the questions for the study, it became evident that the NCI experts did not understand the lifestyles/lifeways of the people of New Mexico. TBDC found the questions to be insensitive; the NCI research team lacked a true understanding of how and what people consumed as food and water in 1945 and beyond. For example, one question asked if the participant was lactose intolerant. The TBDC pointed out that this word was not used in 1945 and that many people in the age range of the participants may not be aware of the meaning of the word.

The TBDC fulfilled its commitments, but the NCI principal scientists, investigators, and staff began to ignore the Trinity downwinders' concerns after getting what they needed to continue their work. Despite the December 3, 2010, recommendation that "government officials should meet with interested stakeholders from around the Trinity site to determine if any additional work is warranted at this site," NCI appears to be contacting those outside of the Tularosa Basin to obtain information about the Trinity test<sup>10</sup>.

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<sup>10</sup> See TBDC website for May and September 2016 TBDC [comments to NCI study](#)



A millionth of a gram of weapons grade plutonium ingested or inhaled into one's body will cause cancer. Over 10 pounds of plutonium did not fission during the Trinity test,<sup>11</sup> and as a result of the detonation on top of a 100-foot tower, the plutonium dispersed across the earth. When first asked to ensure that the un-fissioned plutonium would be included in its dose calculation, NCI refused to include it. They claimed that there were no peer-reviewed scientific reports supporting that fact. The TBDC referred NCI to the LAHDRA report, which clearly states that it is a peer-reviewed scientific report.<sup>12</sup> After many months, NCI agreed to account for the un-fissioned plutonium in its scientific inquiry.

In another instance, NCI refused to accept the TBDC concerns about resuspension of particulate matter in the winds. NCI did not want to address the at times fierce winds in the Tularosa Basin. The TBDC provided evidence of the fierce winds. (See Figure 6.) NCI finally agreed to review the resuspension issues.

NCI is conducting a study on diet and lifeways of Native American and Hispanic Peoples. Their overall Trinity Study objectives ("Update on the NCI Trinity Study of Diet and Lifeways") are to:

1. Develop mathematical models for diet and lifeways to estimate radiation dose,
2. Produce estimates of organ-specific radiation doses,
3. Estimate radiation doses and potential range of cancer risks, above expected in the absence of Trinity, and
4. Provide New Mexico communities with a summary of the study findings.

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<sup>11</sup> See [Chapter 10, "Trinity Test,"](#) in LAHDRA report

<sup>12</sup> The LAHDRA report states that, "In June, 2009, the final draft version of the report was released, and underwent peer-review by a panel of experts at the direction of the CDC" (21-A-1).



Figure 6. “WARNING: DUST STORM AREA NEXT 2 MILES” sign near the entrance to the Stallion Gate at the Trinity site

Because of the amount of time that has passed since the test, and the fact that the U.S. government has not studied the Trinity downwinders as they have studied people exposed to the nuclear weapons tests in the Marshall Islands, Nevada Test Site, and other locations around the world, the NCI plans to host community focus groups and interview key informants in order to “capture a range of behaviors in terms of intakes, building materials, collection and use of water, and time outdoors. In addition, given that activities are not homogenous across the fallout region, we chose to interview groups in varying topographies and community settings.” NCI plans to conduct key informant interviews to “collect community-level information about water, buildings, time spent outdoors, lifeways and consumption of specific foods” (“Supporting Document A”). NCI will use computer models of diet and lifeways in order to estimate the dose, but those computer models were designed for detonations that occurred high in the atmosphere, not 100 feet above the ground as with the Trinity test. Using atmospheric detonation computer models, this process will dilute the actual dose that was delivered across New Mexico, the



fifth largest state in United States. NCI will be unable to reveal the exposures of individual people of New Mexico, especially the Trinity downwinders. These models cannot reveal the actual dose delivered to individuals who were present and downwind of the Trinity test.

NCI received approvals from various institutional review boards (IRBs) in New Mexico. NCI submitted a request to the federal Office of Management and Budget (OMB) for approval of Phase II of their project. Phase II, as TBDC understands, will involve focus groups and interviews with more than nine participants, thus requiring OMB approval. A notice in the Federal Register for “Study to Estimate Radiation Doses and Cancer Risks from Radioactive Fallout from the Trinity Nuclear Test, 0925-NEW, New Submission, National Cancer Institute, National Institutes of Health,” advertised a 60-day public comment period. NCI sought comments about the proposed data collection process, as well as “instruments” about the pre-focus group guide, focus groups, consent form, key informants, academics interview, and recruitment screener. The TBDC found major problems with the interview questions because NCI did not ask appropriate questions for land-based peoples who lived sustainably for generations.

The notice indicated that anyone interested in obtaining a copy of the data collection plans and instruments was required to contact the staff scientist. Despite numerous TBDC requests to NCI to provide the documents, NCI failed to provide the documents. In fact, the documents were not available at the time the notice was published in the Federal Register at the beginning of the 60-day comment period. The TBDC had to contact the New Mexico Congressional delegation have them request that OMB and the Director of the National Institutes of Health (NIH), of which NCI is a part, extend the comment period. As a result, OMB granted a three-week extension of time because the documents were not available to the public for the entire 60-day period. The extension was granted after the New Mexico Congressional delegation wrote a joint letter to OMB and NIH, which can be found on the HIA section of the TBDC website under [“NM Congressional Delegates Request Extension.”](#)

The NCI finally provided the TBDC with a 135-page file containing supporting statements A and B and attachments 1-11. We inquired about the original document to which the supporting statements corresponded, but we never received any original or associated



documentation regarding this planned NCI study.<sup>13</sup> The name that we have given the NCI study in this report refers to the title of the “Supporting Statement A” in this packet of supporting statements and attachments. You can find these documents on the TBDC website under “[National Cancer Institute Study Information.](#)”

The TBDC responded with 13 pages of concerns, the only public comments submitted, on May 31, 2016. LAHDRA researcher and author Dr. Joseph Shonka assisted the TBDC with the comments. On July 8, 2016, the TBDC received an unsigned memo from the staff scientist with an incomplete response to TBDC’s formal public comments. You can find these comments on the HIA section of the TBDC website under “[TBDC Comments to NCI Study.](#)”

On August 25, 2016, NCI published another Federal Register notice regarding “Submission for OMB Review; 30-Day Comment Request Study to Estimate Radiation Doses and Cancer Risks from Radioactive Fallout From the Trinity Nuclear Test – National Cancer Institute (NCI).” The notice explained that NCI will collect information about the diet and lifestyles from three groups in New Mexico— non-Hispanic white, Hispanic, and Native American— who were alive in the 1940s “for a radiation-related cancer risk projection study for the residents of the state of New Mexico potentially exposed to radioactive fallout from the Trinity nuclear test conducted in 1945” (81 Fed. Reg. 58522). They have requested three years to collect this information.

TBDC prepared and submitted to OMB 17 pages of formal comments. As of mid-February, 2017, OMB has not responded to TBDC’s comments.

NCI has committed to providing an initial report for stakeholders in New Mexico in 2017 as well as author several peer-reviewed scientific publications (“Update on the NCI Trinity Study of Diet and Lifeways”). In NCI’s monthly “Trinity stakeholder update” email to the TBDC and others for January 2017, they reported: “With the passage of the 21<sup>st</sup> Century Cures Act in December 2016, OMB review for this study, and any other research effort, is

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<sup>13</sup> A web search for this document now produces “Supporting Document A,” dated August 18, 2016. The document received by TBDC has no date.



removed. We were at the end of the review process, but it's good to know that we can now proceed."<sup>14</sup>

#### **1.5.4 Marshall Islands**

The U.S. performed epidemiological studies and health monitoring in the Marshall Islands of the Pacific because of the 105 nuclear weapons atmospheric and underwater tests conducted by the U.S. in the late 1940s through the mid-1950s on the Marshall Islands and its peoples. Some data presents evidence of small children with thyroid cancer incidence rates 3-4 times higher than adults who were exposed. This is because children by nature are more susceptible to certain types of cancers from harmful radiation.<sup>15</sup> Persons who were children, especially in certain counties surrounding Trinity, at the time of the 1945 Trinity nuclear test have had higher rates of thyroid disease and cancer following the July 16, 1945, atomic bomb blast than the general population.

Like the Trinity downwinders, the Marshall Islanders have never been included in RECA. The TBDC supports an amendment that would also include the Marshall Islanders, who were exposed to multiple nuclear tests during the duration of the atmospheric testing that occurred in their communities.

#### **1.5.5 Trevor's Law and the Frank R. Lautenberg Chemical Safety for the 21<sup>st</sup> Century Act**

Trevor's Law is "the 'Strengthening Protections for Children and Communities From Disease Clusters Act" (formerly Senate Bill 76), introduced on January 25, 2011, by Senator Barbara Boxer (D-CA) in the Environment and Public Works Committee. This bipartisan bill was Co-Sponsored by Senator Mike Crapo (R-ID). SB 76 was re-introduced on January 22, 2013, and is now known as bill SB 50 with companion bill SB 53" ("What Is Trevor's Law?"). Named after brain cancer survivor Trevor Schaefer from Boise, Idaho,

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<sup>14</sup> Full text of the 21<sup>st</sup> Century Cures Act (Public Law No. 114-255) is available on the [Library of Congress website](#). The relevant section is Sec. 2035, "Exemption for the National Institutes of Health from the Paperwork Reduction Act requirements."

<sup>15</sup> See page 287 in BEIR VII report, "Thyroid Cancer."



this legislation was developed to assist communities in determining possible connections between “clusters” of cancer, birth defects and other diseases, and contaminants in the environment (“What Is Trevor’s Law?”). The federal legislation requires the government to track, document, monitor, and treat cases related to “clusters.” President Barack Obama signed this bill into law in June 2016.

TBDC plans to investigate historical documents for evidence of toxic chemicals and heavy metals present in the soil, air, water, and vegetation surrounding Trinity ground zero.



## CHAPTER 2: IMPACTED COMMUNITIES IN THE TULAROSA BASIN

The LAHDRA fallout plume map of the Trinity test shows that isoexposure (mR/hr @ H +12 h) covered New Mexico counties and entered Colorado. The TBDC questions the accuracy of that map. However, the scope of our study examines communities in the Tularosa Basin that were significantly impacted by radioactive fallout from the Trinity test as evidenced by current cancer clusters. The Tularosa Basin covers 6500 square miles, and the majority of the basin exists in Otero County. Our study extends to the four counties of Lincoln, Otero, Sierra, and Socorro.

### 2.1 Background

Given the amount of fallout that swept across New Mexico, including the counties of Lincoln, Otero, Sierra, and Socorro as a result of the Trinity test, we predict that the solid tumor cancers, the leukemias, lymphomas, thyroid cancers and non-cancer diseases, and other rare illnesses that pervade residents of these counties can be directly linked to the Trinity test. At this time it is not possible for the TBDC to complete an accurate, full-dose epidemiological reconstruction of the Trinity site given the variables; however, the scientific and sociological information significantly suggests a cause and effect relationship between the radiation exposure and diseases in these counties related to the Trinity nuclear test fallout of 1945.

The unique exposures of the Trinity downwinders have been ignored and many of the people who had direct experience with the Trinity nuclear test of 1945 have since died. The U.S. Government has not investigated the contamination, the impacts to the health, well-being, or environment of the people. New Mexicans are the unknowing, unwilling, and uncompensated human subjects of the Trinity test. Over 70 years have passed since the fateful Trinity test; incredulously, the people are finding that they need to prove to the U.S. Government and our legislators that they were exposed and are suffering ill health effects related to toxic radiation exposure.



Without having to demonstrate exposures, individuals who lived downwind of the Nevada Test Site became eligible for lump sum compensation awards in the amount of \$50,000. This includes people in parts of Nevada, Utah, and Arizona. Downwinders of the Trinity test in New Mexico have never been included in the RECA fund although the people of New Mexico were the first downwinders in the history of nuclear testing. In the last 25 years, the RECA fund has paid out over \$2 billion in claims and provided invaluable health care coverage to the downwinders of the Nevada Test Site.

In his book, *Secret Fallout: Low-Level Radiation from Hiroshima to Three-Mile Island*, radiation physicist Ernest Sternglass discusses the effects of nuclear reactor emissions and nuclear weapons testing worldwide during the 1940s-50s. Chapter 10, entitled [“The Clouds of Trinity,”](#) describes the fallout from Trinity, which was 20-30 times greater than the fallout from later similar-sized tests. Because the Gadget was detonated at a low height of 100 feet and the fireball touched the ground and created enormous amounts of radioactive soil and vaporized rock, this fallout was deposited on roofs, fences, soil, grasses, livestock, fresh vegetables, fruits, nut crops, water sources, and hay that week of July and beyond. The intensely radioactive short-lived isotopes, such as Iodine-131 (affecting thyroid), as well as the longer-lived isotopes, such as Strontium-90 (affecting red bone marrow), quickly found their way into the milk and foods of the inhabitants of the area, thus into the unborn children in their mother’s wombs. Along with 60 other toxic radioisotopes released by the detonation, thyroid disease, leukemia, lymphoma and other toxic health effects were the eventual results.

In his recent comments prepared for the TBDC to the NCI’s Study to Estimate Radiation Doses and Cancer Risks from Radioactive Fallout from the Trinity Nuclear Test, Dr. Joseph Shonka, a member of the CDC’s LAHDRA team and a co-author of the [final report](#), describes the increase of local fallout, which resulted in significant exposures to the fission products which condensed on the soil as the fireball cooled during the Trinity test. The Gadget was supposed to detonate at a height of 100 feet and then rise immediately high into the air and disperse. Instead, the fireball, at approximately 400 feet, made significant contact with the earth and lofted a considerable mass of soil into the fireball. Dr. Shonka states that this effect contradicted the scientists’ expectations prior to the test. Before the test, Manhattan Project scientists, Hans Bethe and Robert F. Christy,



authored a “Memorandum on the Immediate After Effects of the Gadget” in which they stated:

The radioactive materials are expected to be near the center of the ball of fire and rise with that ball of fire to the stratosphere. Presumably the ball of fire will rise to very considerable height (100 kilometers or more) before its rise is stopped by either diffusion or cooling. If the radioactive material ever comes down again it will certainly be spread out over a radius of at least 100 kilometers and probably very much more and will, therefore, be completely harmless. (Bethe and Christy qtd. in Shonka)

These results regarding the necessary height of nuclear (explosives) tests became an indicator for future tests but not without penalty for the downwinders of the Trinity test. After Trinity, the scientists urged the use of a larger area and no tests were conducted from a 100-foot tower. The LAHDRA final report notes that:

From the Trinity test, it was learned that detonating a nuclear explosive device close to the ground increases the radioactive fallout from the event. Detonating devices at higher elevations results in the dispersion of less radioactivity, while yielding more blast power. Based on experience with the Trinity event, and expanded upon in test series conducted in the Pacific during 1946 and 1948, the potential for exposure of workers and members of the public to fallout became known and appreciated. (Anspaugh 2000 qtd in Shonka)

In addition to the harmful effects related to the height of the burst, fallout, hot spots, and precipitation were major lessons in the Trinity test. Dr. Shonka notes that “it rained following the Trinity test, and failure to consider the enhanced deposition from rain would also miss localized hot spots. With the lack of detailed meteorological data from the test, these hot spots must be treated using uncertainty” (Ibid.).

In referencing the LAHDRA final report, Shonka states that during public meetings of LAHDRA, community members commented that “a snow like substance (fallout) fell for days after the test, likely due to strong winds encountered in the desert driving resuspension. This is also amplified in statements that fence posts appeared to be frosted from the fallout, also likely due to wind driven resuspension” (Shonka comments).

Lansing Lamont’s detailed account, *Day of Trinity*, discusses the weather patterns of July 16, 1945, in great detail by consulting National Weather maps and other local maps, along with Trinity plume direction via military reports and eyewitness accounts. He writes:

The [fallout] cloud drifted northeastward at about ten miles per hour, dropping its trail of fission products across a region measuring 100 miles long and 30 miles wide.



In the deep ravines, where cattle grazed, the radioactivity settled in a white mist; but in the populous uplands there was far less activity. The monitors feared, however, a phenomenon known as inversion. The canyons north of Trinity are like the teeth of a comb, and the sun and the cool air in them squeeze together to produce thermal updrafts that cause sudden wind shifts. These wind shifts, or inversions, might lift the fallout as it began to settle and carry it far beyond the expected limits, dumping it in some remote area unknown to the monitors. (Lamont 251-52)

But the fallout *was* dumped in remote areas. Lamont reports that the fallout cloud skipped the predicted path and spewed radioactive ash on cattle ranches along the Chupadera Mesa west of Carrizozo, to name one area (253). Additionally, reports of the fallout came from as far away as New York.

In his study “Radioactive Clouds of Death Over Utah: Downwinders’ Fallout Cancer Epidemic Updated,” Dr. Daniel W. Miles states that,

A few days later the fallout cloud passed over Rochester, New York. Film inspectors at Eastman-Kodak found hundreds of splotches on the green 14-by-17-inch film sheets used for industrial X-rays. Kodak’s radiation specialists soon found that the splotches were caused by fallout from Trinity. The Trinity blast produced more fallout downwind than any atomic bomb detonated at the Nevada Test Site (NTS) because it was detonated so close to the ground. (7-8)

Given the fallout from Trinity being documented from the other side of the United States, it is no surprise that the “fallout from Trinity exposed those living within 30 miles of the hypocenter to a far greater radiation dose than that received by southwestern Utahans from shot Harry [...]”<sup>16</sup> (Miles 29). Given these high levels of exposure, we believe that the

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<sup>16</sup> The U.S. government conducted the nuclear test “Harry” on May 19, 1953 as part of operation “Upshot-Knothole,” a series of 11 nuclear weapons tests at the Nevada Test Site. Miscalculations and an unanticipated change in wind direction resulted in a blast that produced more radioactive fallout than any other continental U.S. test. The test later assumed the nickname “Dirty Harry.” According to the Comprehensive Nuclear-Test-Ban Treaty Organization,

In many lawsuits, downwinders have sought financial compensation. In a landmark ruling in 1984, families of 10 people who had allegedly contracted cancer as a result of the series of above-ground nuclear tests in Nevada in the 1950s and 1960s were awarded US \$2.6 million in damages. The court also ruled that the government was guilty of negligence in the way it had conducted the tests. (“19 May 1953-Dirty Harry”)



high rates of cancer and thyroid disease in the four counties of interest is directly linked to the Trinity test.

## **2.2 Counties of Interest**

This study focuses on four counties in New Mexico that have been significantly impacted by the Trinity test. The four counties are located, in part or in total, in the Tularosa Basin. (See Figure 7.) The TBDC has collected health surveys from current and former residents and their children from Otero and Socorro Counties. The TBDC has plans to continue our research and collect additional health surveys, with an emphasis on Lincoln and Sierra Counties.

### **2.2.1 Lincoln**

Lincoln County is located in south central New Mexico, east of the Trinity site. It includes, but is not limited to, the communities of Ruidoso, Carrizozo, Capitan, and Corona.

In the most recent U.S. Community Survey for Lincoln County (2015), the county had a population of 19,931 people. The median age in the county was 50.4 years old. Of those people, 6,212 (31.2%) identified as Hispanic or Latino (“Lincoln County, New Mexico”). The number of people who lack health insurance is higher than the state average (16.8%) in Lincoln County; it’s 20.2%. The percentage of residents who obtained a Bachelor’s degree or higher education is at the state average, 26.1%, and below the national average (29.3%). 20.1% of residents in the county live in poverty. The median household income of \$41,710 in Lincoln County is lower than the state average of \$44,968 and lower than the national average of \$53,482 (“Quick Facts”).

According to the New Mexico Department of Health (DOH), 12.5 women per 100,000 die from breast cancer in Lincoln County. This is lower than the state average of 20 women per 100,000. The report also notes that this number is statistically unstable, meaning it may fluctuate widely. For lung cancer, 37.3 people per 100,000 die in Lincoln County versus 31.6 people per 100,000 in the State of New Mexico. The DOH considers these statistics “Improvement Needed.” While smoking is considered the largest risk factor for lung cancer, exposure to radioactive radon gas is the second leading cause. Between 2007-2011, the New Mexico DOH cites an average of 133.3 cancer deaths per year in



Lincoln County per 100,000 people (“Health Indicator”). This places it in the “orange” zone or “peer group 2.” In contrast, the NCI and the CDC list Lincoln County as having a cancer rate falling and below the state average and below the national average and falling (“Rate/Trend Comparison”).

### **2.2.2 Otero**

Otero County is located in south central New Mexico, southwest of the Trinity site. It includes, but is not limited to, the communities of Alamogordo, Boles Acres, Cloudcroft, Holloman Air Force Base, La Luz, Mescalero, Timberon, and Tularosa.

In the most recent U.S. Community Survey for Otero County (2010), the county had a population of 63,797 people. The median age in the county was 36.5 years old. Of those people, 22,026 identified as Hispanic or Latino. The number of people who lack health insurance is higher than the state average (16.8%) in Otero County; it’s 18.1%. The percentage of residents who obtained a Bachelor’s degree or higher is at or below the state average (26.1%) and below the national average (29.3%): Otero: 17.2%. Over 20% of residents in the county live in poverty: 20.2%. The median household income of \$40,614 in Otero County is lower than the state average (\$44,968)

6 Simulation of Ground-Water Flow in the Basin-Fill Aquifer of the Tularosa Basin, South-Central New Mexico

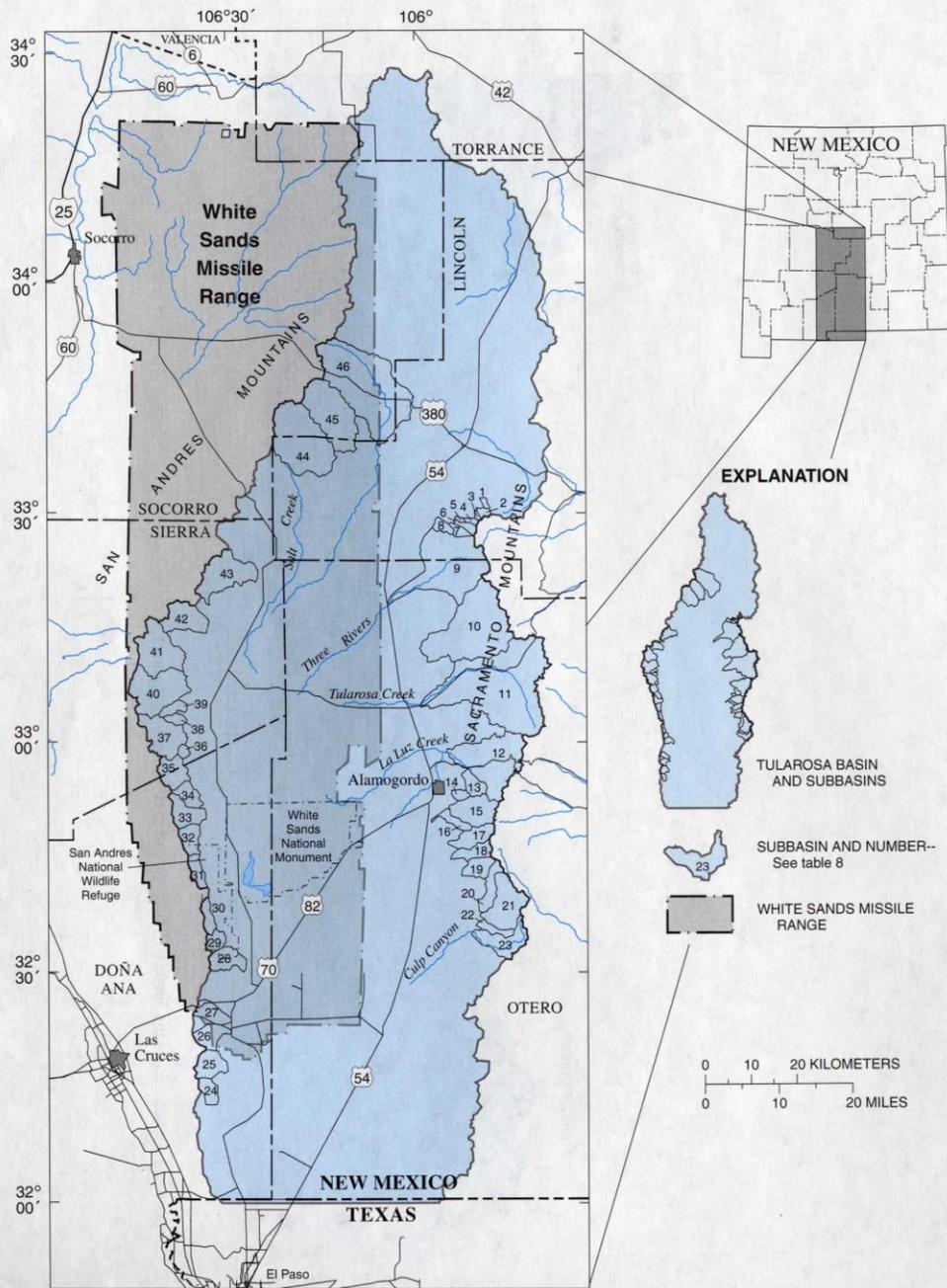


Figure 3. Location of subbasins on the margin of the Tularosa hydrologic basin (modified from Waltemeyer, 2001).

Figure 7. United States Geological Survey map of the Tularosa Basin indicating Lincoln, Otero, Sierra, and Socorro Counties and the White Sands Missile Range.



According to the New Mexico DOH, 24.2 women per 100,000 die from breast cancer in Otero County. This is higher than the state average of 20 women per 100,000. The DOH considers Otero County in “Improvement Needed” in this area. For lung cancer, 42.8 people per 100,000 die in Otero County versus 31.6 people per 100,000 in the State of New Mexico. The DOH considers these statistics “Reason for Concern.” While smoking is considered the largest risk factor for lung cancer, exposure to radon gas is the second leading cause. Between 2007-2011, the New Mexico DOH cites an average of 156.8 cancer deaths per year in Otero County per 100,000 people (“Health Indicator”). This places it in the “dark orange” zone or “peer group 3.” In contrast, the NCI and the CDC list Otero County as having a cancer rate that is stable and similar to the state average and stable and similar to the national rate (“Rate/Trend Comparison”).

### **2.2.3 Sierra**

Sierra County is located in southwestern New Mexico. It includes, but is not limited to the communities of Elephant Butte, Truth or Consequences, and Williamsburg.

In the most recent U.S. Community Survey for Sierra County (2015), the county had a population of 11,615 people. The median age in the county was 55.6 years old. Of those people, 3,380 (29.1%) identified as Hispanic or Latino (“Sierra County, New Mexico”). According to the 2010 Census, 17.9% of the population lacks health insurance, which is higher than the state average (16.8%). The percentage of residents who obtained a Bachelor’s degree or higher education is 18.9%, which is lower than the average (26.1%) and below the national average (29.3%). The percentage of residents in the county live in poverty is 23.8%. The median household income of \$28,855 in Sierra County is lower than the state average of \$44,968 and lower than the national average of \$53,482 (“Quick Facts”).

According to the New Mexico DOH, 17.4 women per 100,000 died from breast cancer in Sierra County between 2008-2012. This is lower than the state average of 20 women per 100,000. For lung cancer, 55.5 people per 100,000 die in Sierra County versus 31.6 people per 100,000 in the State of New Mexico. The DOH considers these statistics “Reason for Concern.” Between 2007-2011, the New Mexico DOH cites an average of 192.8 cancer



deaths per year in Sierra County per 100,000 people (“Health Indicator”). This places it in the “red” zone or “peer group 4.” In contrast, the NCI and the CDC list Sierra County as having a cancer rate that is stable and above the state average and stable and similar to the national rate (“Rate/Trend Comparison”).

#### **2.2.4 Socorro**

Socorro County is located in the central part of New Mexico. It includes, but is not limited to, the communities of Socorro, Magdalena, Bingham, Luis Lopez, and San Antonio. The County of Socorro is home to the New Mexico Institute of Mining and Technology, the National Radio Astronomy Observatory, the Very Large Array, the Magdalena Ridge Observatory, and the Langmuir Laboratory for Atmospheric Research. It is important to note how many scientific institutions are located in Socorro County.

In the most recent U.S. Community Survey for Socorro County (2015), the county had a population of 17,494 people. The median age in the county was 36.8 years old. Of those people, 8,598 (49.1%) identified as Hispanic or Latino (“Socorro County, New Mexico”). According to the 2010 Census, 18.6% of the population lacks health insurance, which is higher than the state average (16.8%). The percentage of residents who obtained a Bachelor’s degree or higher education is 19.2%, which is lower than the average (26.1%) and below the national average (29.3%). The percentage of residents in the county live in poverty is 31%. The median household income of \$33,570 in Socorro County is lower than the state average of \$44,968 and lower than the national average of \$53,482 (“Quick Facts”).

According to the New Mexico DOH, 23.8 women per 100,000 die from breast cancer in Socorro County. This is higher than the state average of 20 women per 100,000. The DOH considers Socorro County in “Improvement Needed” in this area. This data is considered relatively stable. For lung cancer, 38.4 people per 100,000 die in Socorro County versus 31.6 people per 100,000 in the State of New Mexico. The DOH considers these statistics “Improvement Needed.” Between 2007-2011, the New Mexico DOH cites an average of 170.8 cancer deaths per year in Socorro County per 100,000 people (“Health Indicator”). This places it in the “red” zone, or “peer group 4.” In contrast, the NCI and the CDC list Socorro County as having a cancer rate that is stable and similar to the state average and stable and similar to the national rate (“Rate/Trend Comparison”).



## CHAPTER 3: HEALTH IMPACT ASSESSMENT (HIA) PROCESS

With the funding and guidance from the New Mexico Health and Equity Partnership (NMHEP), the TBDC was afforded an opportunity to study the health impact that RECA would have on New Mexicans, particularly those living in the Tularosa Basin, if the legislation were to be amended to include Trinity test downwinders. This report is the culmination of these findings. Our process officially began in January 2016, when the core members of the TBDC and several community members of TBDC who were instrumental in collecting data during the HIA process attended a training in Santa Fe, New Mexico. The HIA findings reflected in the remainder of this document reflect the current conditions and anticipated effects that a RECA amendment would have for residents of the Tularosa Basin, including those in Lincoln, Otero, Sierra, and Socorro Counties.

### 3.1 Health Impact Assessment Overview

Health Impact Assessment (HIA) is a process that engages community stakeholders in the research process by utilizing stakeholder input in combination with various other data sources. The goal of any HIA is to research how a program, plan, or policy will impact the health of a given population. In general, HIAs investigate policies and programs that are not health-specific. They do this using social determinants of health, otherwise called health determinants in our study. These are the catalysts for health changes or outcomes of a particular policy or program. The HIA process (Table 1) revolves around six steps: screening, scoping, assessment, recommendations, reporting, and monitoring.



## HIA Process

Screening	Determines the need and value of an HIA
Scoping	Determines which health impacts to evaluate, methods for analysis, and a work plan
Assessment	Provides a profile of existing health conditions and an evaluation of potential health impacts
Recommendations	Provides strategies to manage identified adverse health impacts
Reporting	Develops the HIA report and communicates findings and recommendations
Monitoring	Tracks impacts on decision-making processes, the decision itself, and impacts of the decision on health determinants

Table 1: Six steps of the HIA process

The **screening** step of this process named and evaluated the problem of radiation fallout due to the 1945 Trinity test, the original 1990 RECA, the year 2000 RECA Amendments, the proposed 2017-18 RECA Amendments, and stakeholder interest in participating in a large-scale survey to inform this HIA. With the help of the New Mexico Health Equity Partnership, the TBDC began the HIA process.

During the **scoping** step, the HIA team determined the three social determinants of health—health determinants—that we would evaluate: lack of access to healthcare, economic impact to patients and families, and generational trauma. We created research questions regarding existing health conditions and the impact of RECA. We also listed indicators and potential data sources.

The TBDC had already begun the survey implementation that would be used as primary data for this HIA when we began the HIA process. Thus, we did not need to develop a new tool for collecting primary data. The survey (Appendix A) includes questions related to medical history including cancer and non-cancer illnesses.



The **assessment** step explored the problem by conducting a thorough literature review on RECA, the effects of radiation fallout on nearby communities, and the history of the Trinity test. On July 17, 2016, the HIA team conducted its first focus group in Tularosa. On October 4, 2016, the HIA team conducted its second focus group in Albuquerque.

The stakeholders for this HIA include all New Mexicans, especially those living in the four counties surrounding the Trinity site: Lincoln, Otero, Sierra, and Socorro; all health care professionals in the State of New Mexico, including tribal community health representatives (CHRs), the New Mexico Department of Health (NMDOH), the University of New Mexico Cancer Center, the State of New Mexico Tumor Registry, Indian Health Services (IHS), Albuquerque Area Southwest Tribal Epidemiology Center (AASTEC), and Albuquerque Area Indian Health Board, Inc. (AAIHB); faith leaders in the State of New Mexico; DHSS; CDC; DOE; and NCI.

The **recommendations** resulted from the findings of the assessment step of this process. While our general recommendation is to amend RECA, we also offer specific revisions that must be made to the proposed 2017 bills. Additionally, we refer to TBDC recommendations related to the NCI study planned for southern New Mexico, a process that has essentially excluded stakeholder participation, including that of the TBDC.

### **3.2 Social Determinants of Health**

According to the World Health Organization (WHO), social determinants of health are “[t]he conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies, and political systems” (*World Health Organization*). During the scoping step of this process, the HIA team decided to focus on three social determinants of health: Lack of Access to Healthcare, Economic Impact(s) to Patients and Families, and Generational Trauma.



### 3.2.1 Pathway Diagrams

The following pathway diagrams (Figures 8, 9, and 10) demonstrate how an amended RECA would have immediate, intermediate, and long-term outcomes or impacts on New Mexicans as it relates to the three health determinants. Figure 7 focuses on lack of access to healthcare. Figure 8 focuses on economic impacts to patients and families. Figure 9 focuses on generational trauma. These pathways guided the investigation into how a RECA amendment would benefit the health of the Trinity downwinders.

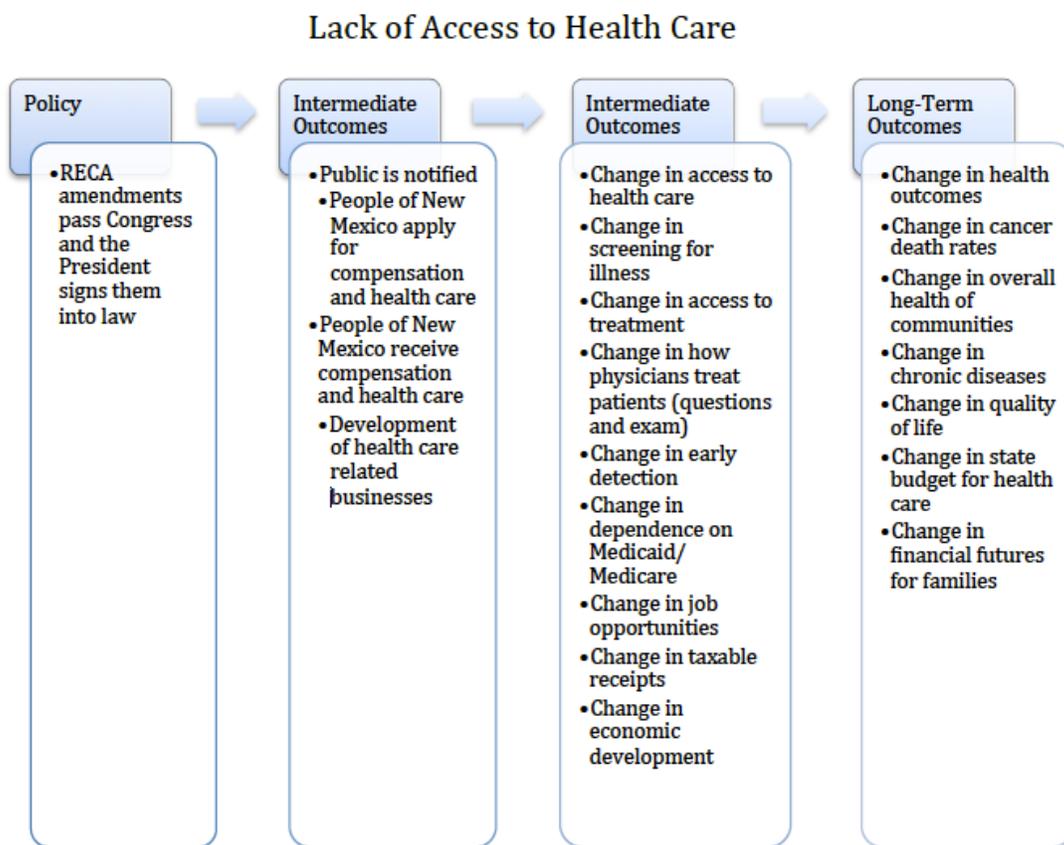


Figure 8. Flow chart depicting the anticipated outcomes related to Lack of Access to Health Care



## Economic Impact to Patients and Families

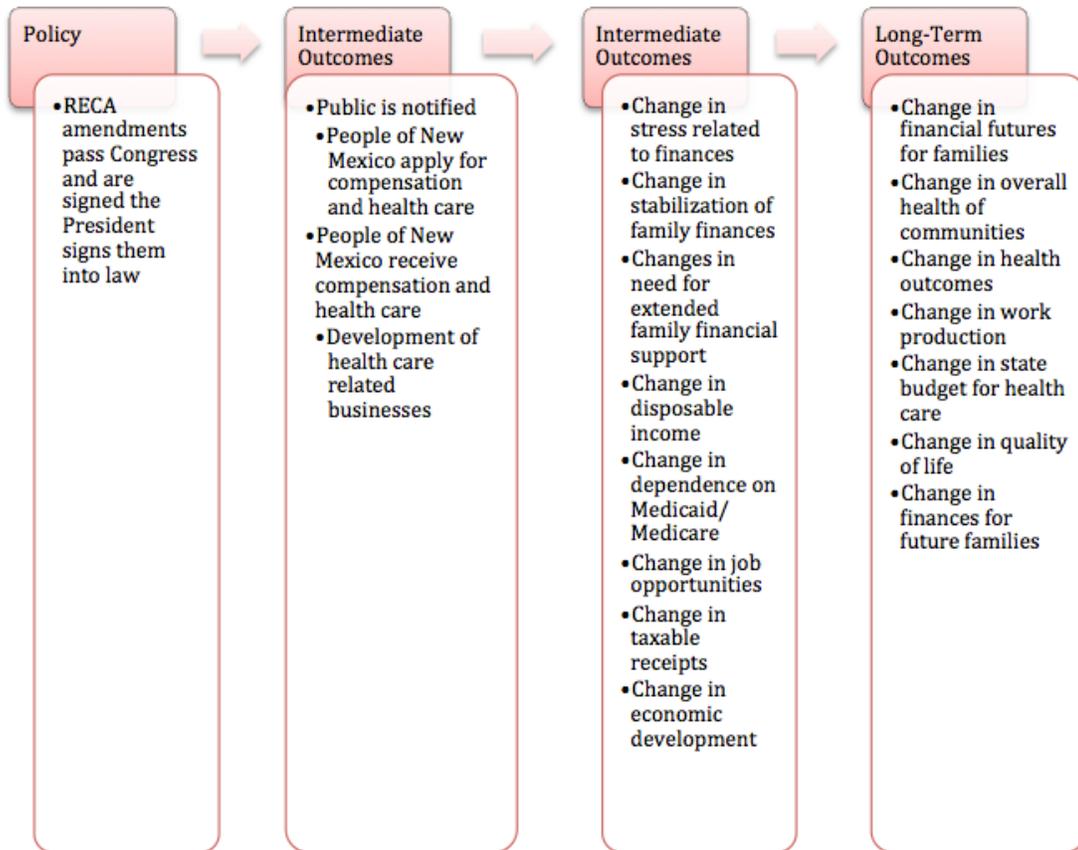


Figure 9. Flow chart depicting the outcomes of Economic Impact to Patients and Families



## Generational Trauma

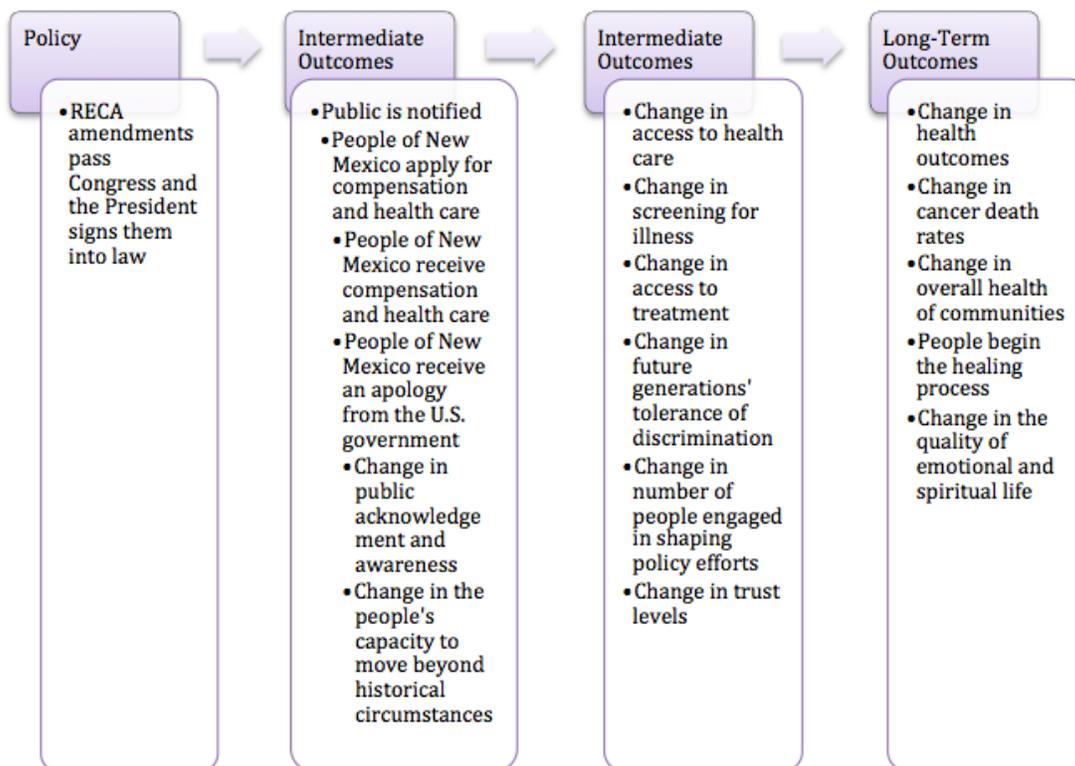


Figure 10. Flow chart depicting outcomes related to Generational Trauma

### 3.3 Methodology and Community Involvement

To date, the HIA team has engaged in three forms of primary data collection: gathering health surveys from current and former residents of Lincoln, Otero, Sierra, and Socorro counties; facilitating focus groups; and collecting written testimonies from community members via town hall meetings.

#### 3.3.1 Health Survey

Tina Cordova, TBDC co-founder, created the health survey. The survey has been distributed in multiple ways throughout the counties of Lincoln, Otero, Sierra, and Socorro counties. Community members of TBDC have been instrumental in distributing the health survey to the senior centers, church events, the candlelight vigil, demonstrations, educational presentations, in the mail, and via email. People can now download the [survey](#) on the TBDC website and mail it in. This tool was designed to survey



people who have lived in the Tularosa Basin and the south central New Mexico counties of Lincoln, Otero, Sierra or Socorro for at least one year after the Trinity site nuclear detonation on July 16, 1945. The survey inquires about medical history and any health problems that the respondent, their parents, or their descendants has or has had. Individuals may fill out surveys for family members who are deceased or otherwise unable to complete their own survey. To see the survey used for the primary data collection during the HIA process, please see Appendix A.<sup>17</sup>

The survey covers medical history for cancer and/or non-malignant tumor diagnosis. It includes cancers and/or tumors in the following areas or systems: digestive system, urinary system, lymph system, respiratory system, breast, female reproductive, male reproductive, and other cancers such as multiple myeloma, bones and joints, leukemia, aleukemia, and central nervous system. The survey also gives respondents the option to list other types of benign tumors, such as kidney and lung. The survey asks for information regarding where the tumor was diagnosed (hospital or doctor's office), where the participant received treatment and what type, and where a deceased person died.

In addition to cancer and/or tumor-related medical history, the survey also inquires about non-cancer medical history and chronic disease(s), such as whether or not the participant has had thyroid or other health problems and whether the participant is or was a cigarette smoker. Finally, the survey enables participants to add additional information including but not limited to thoughts on the emotional, psychological, or financial effects of disease in their families.

### **3.3.2 Focus Groups**

The TBDC conducted two focus groups during the HIA process. The initial focus group was conducted in Tularosa, New Mexico, on July 17, 2016, with current and former residents of the Tularosa Basin. The second focus group was conducted in Albuquerque, New

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<sup>17</sup> This survey was developed before TBDC began the HIA process with NMHEP. It has periodically been revised or updated. The TBDC anticipates further revising the survey based on our analysis of the findings for the HIA.



Mexico, on October 4, 2016, with descendants of Trinity test downwinders who were living in Lincoln County on July 16, 1945. The participants included members of two generations of women in one particular family in which almost every family member has experienced cancer.

### **3.3.3 Written Testimonies**

The TBDC has obtained written testimonies from eight people who are current or former residents of Lincoln, Otero, Sierra, and Socorro Counties. The majority of these histories were written in preparation for a meeting with Senator Tom Udall (D-NM) on July 1, 2015. Senator Udall and Senator Heinrich are two sponsors of the proposed RECA Amendment in the U.S. Senate.



## CHAPTER 4: FINDINGS

The following section describes the impacts of the RECA amendments on New Mexicans and how lack of access to health care, economic impact, and generational trauma affect their health and the health and well-being of their families, including the subsections Lack of Access to Health Care, Economic Impact to Patients and Families, and Generational Trauma.

### 4.1 Lack of Access to Healthcare

This section addresses the lack of access to adequate healthcare, especially for healthcare related to cancer diagnosis and treatment, in southern New Mexico. Findings from the health surveys, focus groups, and written testimonies are used to examine how an amendment to RECA to include the Trinity downwinders would impact the stakeholders.

#### 4.1.1 Current Health Conditions

Currently, the closest facility to treat patients diagnosed with cancer is the University of New Mexico Comprehensive Cancer Center in Albuquerque. Residents of Lincoln, Otero, Sierra, and Socorro Counties travel upwards of 200 miles to Albuquerque to the UNM Comprehensive Cancer Center. For example, it is approximately 210 miles one-way from Alamogordo to Albuquerque. In many cases, a patient and his/her caregiver and/or family accrue additional expenses to stay overnight in Albuquerque, with costs for housing, meals, and mileage.

Many focus group participants spoke about thyroid diseases, autoimmune diseases, and the number of rare cancers in their small communities. The following excerpts were taken from the focus groups, written testimonies, and health surveys.

One man who grew up in Tularosa and currently lives in Arizona spoke about the various illnesses that members of his immediate family suffer from, including but not limited to breast cancer, gout, blood disorders, kidney disease (three siblings living on one kidney each), prostate cancer, thyroid disease, throat cancer, and stomach problems. He



traveled 150 miles each way, 5 times a week for five weeks, to receive treatment in El Paso while living in New Mexico and before moving to Arizona where he could more easily receive treatment.

One Tularosa woman discussed being in remission from colon cancer. Her brother was diagnosed with leukemia. Her 82-year-old sister has kidney cancer; her chemotherapy was to start the following Tuesday.

A woman currently living in La Luz, New Mexico, (approximately six miles south of Tularosa) has a 14-year-old-son who suffers from a rare form of lymphoma. He recently visited a doctor after suffering a fall. During the exam the doctor inadvertently discovered the lymphoma. He is currently being treated for his lymphoma in El Paso.

A family reports living in Oscuro, New Mexico, on July 16, 1945, along with other families. After the Trinity bomb detonated, their chickens died. The family dog died. The individual's mother hung bed sheets on the windows and wet them to keep the dust [fallout] out of the house.

A man born in November 1941 moved to the Tularosa Basin in December 1941 and lives there today. He reports having lung cancer (with surgery), prostate cancer, and thyroid cancer. He traveled to Mountain View Regional Medical Center in Las Cruces to have a tumor removed from his lung, and now he travels from Alamogordo to Las Cruces for treatment related to his prostate cancer. He reports on his survey that his wife also suffers from "different types of cancers and diabetes."

A man born in April 1945 who has lived in Socorro his entire life reports having had prostate cancer. He traveled to UNM Cancer Treatment Center in Albuquerque, New Mexico, for treatment, which included radiation treatment for eight weeks.

A woman born in July 1946 in San Patricio, New Mexico, was born without a hand. She resided in the Tularosa Basin from July 1946 to May 1982. She currently lives in Texas, where she was diagnosed with kidney cancer in 2002 and thyroid cancer in 2003. She



underwent surgery at Las Colinas Medical Center (in Texas). She had her thyroid removed because of the cancer.

A woman born in September 1930 in Bosquecito, New Mexico, was living in Bingham, New Mexico when the bomb exploded at the Trinity site. She has lived in Socorro for many decades. She was diagnosed with breast cancer in April 2007 at Presbyterian Hospital in Albuquerque, New Mexico. The same doctor who diagnosed her cancer performed her mastectomy. She later received treatment at the New Mexico Cancer Center in Albuquerque, New Mexico. She reports losing both parents to cancer each at the age of 65 years. Her oldest sister also had breast cancer, and her younger brother died from pancreatic cancer in 2015.

Further, there were no running water systems in the small villages, ranches, and farms in Lincoln, Otero, Sierra, and Socorro Counties in 1945. Everyone depended on a cistern or the open ditch system that runs year round through the towns. In some towns there were holding ponds where water collected. People took water from the ponds when their cisterns ran dry or when they had no cistern. Sediment, likely containing fallout from the Trinity atomic bomb, would settle in the cisterns and ponds. The primary water sources for the towns west of the Sacramento Mountain chain is run off that flowed from the mountains northeast and east of Trinity into the valleys below.

On the Mescalero Apache Tribal Lands, people were not living in structures built of lumber or adobe. Many lived in temporary structures made of tree branches or canvass. Their exposure would have been different from those who lived in permanent-type structures.

#### **4.1.2 Health Insurance Coverage**

Medicaid is a federal program but is jointly administered with the states. Each state has its own criteria and budget and willingness to accept federal funds. Thus, actual dollar amounts distributed from the Federal Government vary. Some states have much higher participation in Medicaid programs than others, including New Mexico, due to the higher rate of unemployment and general poverty in our state.



Fifty-two percent (52%) of **Lincoln County** residents have public health coverage. Of those, 27.8% have public health insurance alone, which are broken down as follows: 7.7% have Medicare coverage alone; 19.3% have Medicaid/means tested coverage alone; and 0.8% have Veterans Affairs (VA) health care coverage alone. Of those with public health insurance alone or in combination, 63.9% are below the 138% of the poverty threshold, while 46.6% are at or above 138 percent of the poverty threshold. Ninety-nine point six percent (99.6%) of persons 65 years and older have Medicare coverage alone or in combination.

Forty-seven percent (47%) of **Otero County** residents have public health coverage. Of those, 27.5% have public health insurance alone, which are broken down as follows: 4% have Medicare coverage alone; 22.7% have Medicaid/means tested coverage alone; and 0.8% have VA health care coverage alone. Of those with public health insurance alone or in combination, 65.7% are below the 138% of the poverty threshold, while 38% are at or above 138 percent of the poverty threshold. Ninety-eight point six percent (98.6%) of persons 65 years and older have Medicare coverage alone or in combination.

Fifty-eight percent (58%) of **Sierra County** residents have public health coverage. Of those, 27.8% have public health insurance alone, which are broken down as follows: 10% have Medicare coverage alone; 17.2% have Medicaid/means tested coverage alone; and 0.6% have VA health care coverage alone. Of those with public health insurance alone or in combination, 66.6% are below the 138% of the poverty threshold, while 52.9% are at or above 138 percent of the poverty threshold. Ninety-eight point six percent (98.6%) of persons 65 years and older have Medicare coverage alone or in combination.

Forty-seven percent (47%) of **Socorro County** residents have public health coverage. Of those, 29% have public health insurance alone, which are broken down as follows: 5.7% have Medicare coverage alone; 23.2% have Medicaid/means tested coverage alone; and 0.1% have VA health care coverage alone. Of those with public health insurance alone or in combination, 57.6% are below the 138% of the poverty threshold, while 41.6% are at or above 138 percent of the poverty threshold. Ninety-three point three percent (93.3%) of persons 65 years and older have Medicare coverage alone or in combination.



#### 4.1.3 Demographics and Health Characteristics of Populations Near Trinity Site

In order to demonstrate that people living outside of the existing fallout plume map were affected by the Trinity test, the TBDC collected health surveys from four counties – two under the plume and two not under the plume. Eighty-two surveys have been collected in Socorro County. Of these surveys, 41 (50%) were male and 41 (50%) were female. Ethnicity was not collected during this process.<sup>18</sup> Forty-seven (57%) of the people who submitted surveys or had surveys submitted for them were born before July 16, 1945. Thirty-five (46%) were born after July 16, 1945. Thirty-six (44%) are deceased and 46 (56%) are living. All persons indicated health problems ranging from thyroid disease to brain cancer. Nineteen percent of the surveyed population has thyroid disease (16 people). Two percent have other types of non-cancerous tumors (2 people). Twenty-six percent of respondents had multiple cancers (21 people).

##### Socorro County

Type of Cancer	Number	Percentage
Breast	16	19%
Unknown	13	16%
Lung	7	8%
Colon	6	7%
Thyroid	5	6%
Kidney	5	6%
Prostate	5	6%
Stomach	5	6%
Liver	4	5%

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<sup>18</sup> Whereas ethnicity was not directly collected during this HIA, we recognize that a large percentage if not the majority of the people who completed health surveys or participated in the focus groups identify as Hispanic. The implication of race and the Federal Government’s denial of RECA coverage to New Mexico and Trinity downwinders that are largely Hispanic would slightly shift the narrative of our argument. For the purpose of this HIA, we regret that we do not have data related to ethnicity to make that argument at this time.



Pancreatic	4	5%
Lymphoma	3	4%
Leukemia	3	4%
Cervical	3	4%
Ovarian	3	4%
Bladder	3	4%
Cervical	3	4%
Aleukemia	1	1%
Trachea	1	1%
Brain	1	1%
Hepatocellular	1	1%
Osteosarcoma	1	1%
Shoulder/chest	1	1%
Multiple Myeloma	1	1%
Carcinoid	1	1%
Small Cell	1	1%
Rectal	1	1%
Skin	1	1%
Bronchi	1	1%

Table 2: Numbers and percentages of cancer in Socorro County by type from health surveys

Four hundred nineteen surveys have been collected in Otero County. Of these surveys, 223 (52%) were female and 196 (47%) were male. Ethnicity was not collected during this process. Two hundred fifty nine (62%) of the people who submitted surveys or had surveys submitted for them were born before July 16, 1945. One hundred sixty (38%) were born after July 16, 1945. One hundred fifty six (37%) are deceased and 263 (63%) are living. All persons indicated health problems ranging from thyroid disease to brain cancer. Twenty percent of the surveyed population has thyroid disease (82 people). Five



percent have other types of non-cancerous tumors (22 people). Twenty eight percent of respondents had multiple cancers (119 people).

### Otero County

Type of Cancer	Number	Percentage
Breast	71	17%
Lung	62	15%
Prostate	41	10%
Thyroid	36	9%
Colon	30	7%
Stomach	23	5.5%
Kidney	21	5%
Skin	21	5%
Brain	20	4.7%
Liver	19	4.5%
Bone	19	4.5%
Ovarian	19	4.5%
Uterine	15	3.6%
Multiple Myeloma	14	3.3%
Leukemia	13	3.1%
Bladder	11	2.6%
Cervical	11	2.7%
Pancreatic	10	2.4%
Non-Hodgkin Lymphoma	8	1.9%
Esophogus	6	1.4%
Throat	5	1.2%
Mouth	4	.09%



Neck	3	.07%
Renal	3	.07%
Spine	3	.07%
Central Nervous System	3	.07%
Gallbladder	2	.05%
Lipoma	2	.05%
Rectal	2	.05%
Hodgkin's Disease	2	.05%
Inguinal Gland	1	.02%
Vulva	1	.02%
Vaginal	1	.02%
Papillary	1	.02%
Follicular Adenoma Bilateral	1	.02%
Spleen	1	.02%
Salivary Glands	1	.02%
Bronchi	1	.02%
Testicular	1	.02%
Eye	1	.02%

Table 3: Numbers and percentages of cancer in Otero County by type from health surveys

## 4.2 Economic Impact to Patients and Families

This section examines the cost of cancer and thyroid disease treatment to patients and their families.

### 4.2.1 Average Cost of Treatment for Residents of Lincoln, Otero, Sierra, and Socorro Counties



The TBDC was unable to accurately assess the average cost of treatment for residents in the Tularosa Basin. Looking ahead, we plan to conduct a separate Phase 2 study that focuses on investigating the cost and access to treatment for Trinity downwinders, both current and former residents of the Tularosa Basin and their descendants. This will require both qualitative and quantitative research. The TBDC is applying for additional grants to conduct this research.

#### **4.2.2. Proximity of Treatment Facilities**

As indicated earlier, the closest major cancer treatment facility is in the city of Albuquerque. Many families from southern New Mexico make the drive to Albuquerque to get treatment. Some families have had to travel out of state to receive treatment. One focus group participant discussed her son's rare brain tumor and the various treatments he has received in different parts of the country. He underwent surgery in Pittsburg, Pennsylvania, and when that was unsuccessful, he traveled to Chicago, Illinois, to receive gamma knife surgery. Currently he is back home and stable, but the tumor is growing.

Another focus group participant discussed making three different trips to Houston. A different focus group participant discussed traveling "back and forth" to Phoenix. Other participants discussed receiving treatment in El Paso, Texas. Because these treatments are administered in other states, they may not be properly registered in the New Mexico Tumor Registry for tracking.

#### **4.2.3 Sacrifices Made to Cover Medical Expenses**

Focus group participants and health survey participants expressed various types of sacrifices, both economic and non-economic, made by individuals, families, and friends. Financially, stakeholders expressed the need to use any money that they had in savings accounts to pay for medical expenses. One man expresses in the survey how cancer treatment was "financially straining" saying that his "savings and resources [had been] depleted." Stakeholders also sold their possessions, including their homes. One woman expressed in the survey: "After my [cancer] recurrence and second surgery in 2014, I had to put my house up for sale due to the numerous medical bills I was incurring. One of the hardest things to do to your children is up and move them from their home." While they have been forced to sell homes and other possessions, they have also incurred severe



debt, as noted by one Hispanic woman in her survey: “Financially, we are still dealing with it. We haven't been able to get caught up on our bills. I am not strong enough to work anymore.” Thus, the inability to work due to severe health conditions often prevents stakeholders from earning a living wage, which places them at risk for additional financial burdens and ultimately affects their future physical, mental, and health. It becomes a vicious cycle of poverty and poor health.

Multiple stakeholders expressed how illnesses affected their entire families and how they have watched family members sacrifice everything they had to cover medical expenses. One Hispanic woman expressed via the survey:

I watched my sister battle breast cancer for four years— undergoing a mastectomy, removing her left breast, receiving chemotherapy and radiation. We not only watched her suffer physically, but financially. Trips to the doctor's appointments all over Southern New Mexico became a financial strain as her income was limited to social security. My parents were the ones who provided what she could not afford, using their retirement savings. My parents are now left to suffer financially, struggling to live off of social security. Nine years later, I was standing in my sister's shoes. I was diagnosed with breast cancer in 2009. Unlike my sister, I had a husband and young children. All I could think about was that I was going to die and who was going to take care of my family? For the next year, I traveled to Albuquerque and Roswell, NM to undergo surgeries, reconstruction surgeries and appointments. The financial strain still burdens me today. I had a scare in February 2015 and underwent another biopsy and I am still making payments towards these medical bills— the financial burden never seems to end.

Beyond the financial sacrifices, stakeholders also expressed how they became caregivers to family members, which created new stressors in their lives.

### **4.3 Generational Trauma**

Perhaps the most impactful part of the findings relates to generational trauma. While some of this focuses on physical health and well-being, a vast majority of the data collected that related to generational trauma affects stakeholders' mental health. Often overlooked as a major component, mental illness can also lead to physical disorders and diseases.



#### **4.3.1 Effects of Physical Health Consequences of the Trinity Test on Later Generations**

Descendants of individuals living downwind and downstream of the bomb blast trace the physical health consequences of the Trinity test on later generations back to the cultural practices of downwinders in the 1940s. These cultural practices largely revolved around an agrarian lifestyle of farming, ranching, fishing, and hunting.

One focus group participant, a woman, expressed how as children, they drank the milk from the cows and skimmed the fat (cream) off the milk. They played in the acequias (ditches). They butchered cows and hunted deer. Now, families who engaged in those practices and were contaminated by radiation are “wiped out.” She stated, “Now we’re mad” that our families and communal traditions have been negatively impacted in irreversible ways.

One family shared their family history of cancer. Three Hispanic women<sup>19</sup> represented two generations in their family. The two older women (sisters) were born in 1945 and 1956. The older sister was born on July 8, 1945, just eight days before the Trinity test. Their parents lived in Carrizozo; their grandparents were also from Carrizozo. After the elder sister was born, the family moved to Albuquerque in 1947, where the younger sister was born. The older sister had her thyroid removed after a doctor diagnosed nodules that the doctor predicted would turn to cancer. The younger sister had thyroid cancer twice and pre-cancerous cells in her uterus, and she had her uterus removed at age 28, eliminating any chance of having more children. The daughter of the older sister also had thyroid cancer and was diagnosed at age 36.

The older sister had her thyroid removed in 2013 and began taking thyroid medication at that time. Dr. Seibel, who treated her, asked her if she had ever been exposed to radiation.

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<sup>19</sup> During this focus group, we were able to discuss ethnicity with the participants. Codeswitching between English and Spanish occurred during the focus group.



The younger sister was diagnosed with thyroid cancer in 2012. She had to return to work within a week after both surgeries. She returned to work with gauze on her neck. She could not afford to take time off from work. She told us, “Everyone else plans vacations; I plan surgeries.” She had to hire help to complete the necessary chores at home that she could no longer perform.

An overview of the health history of this family reveals a cancer cluster in this family.

- The sisters’ mother’s father, who was living in Carrizozo (Lincoln County) in the Tularosa Basin at the time of the Trinity test, had bone cancer.
- Their mother was treated for three different types of cancer: skin, thyroid, and breast. She also suffered from dementia before she died. She had eight siblings— six sisters and two brothers.
- Their mother’s sister (mother’s sister one) had breast cancer and thyroid issues. She was born in Carrizozo.
  - Her daughter has thyroid disease.
- Their mother’s sister (mother’s sister two) has a daughter who had thyroid cancer. A new tumor was recently located and deemed inoperable because it is too close to her carotid artery. Another one of her daughters had thyroid disease.
- Their mother’s sister (mother’s sister three) has dementia.
  - Her daughter has thyroid disease.
- Their mother’s brother has a son with thyroid disease, who had a thyroidectomy due to the numerous suspicious tumors in his thyroid.
- Their mother’s sister (mother’s sister four) died of bone cancer.
  - Her son had stomach cancer and died soon after diagnosis.
  - One daughter had thyroid cancer.
  - One daughter had a brain tumor and may currently have another one.
- Their mother’s sister (mother’s sister five) has a daughter who had a brain tumor.
  - Her son had prostate cancer and a brain aneurism.
- Their mother’s sister (mother’s sister six) had a daughter who died of Leukemia.

The two sisters had different fathers.

- The older sister’s father had a sister who had cervical cancer.
  - Her son has esophageal cancer.
- The older sister’s father had a first female cousin who had thyroid disease and died of breast cancer.



- Her son died of colon cancer.
- Her husband, who worked at the Los Alamos National Laboratory and at the White Sands Missile Range, died of lung cancer.
- The younger sister's father died of Chronic Obstructive Pulmonary Disease (COPD), and he also had a tumor on one of his lungs. He was born in Carrizozo.
  - Her father had two brothers who died of cancer. They were also born in Carrizozo.
  - Her father had a sister who died of cervical cancer. That sister has a daughter who is currently under a doctor's care with colon cancer (October 2016).

The sisters have siblings who have become ill.

- One brother has thyroid disease.
- One brother had prostate cancer.
- One brother had thyroid cancer and received radiation treatment twice. He had to retire from teaching.
  - His daughter had thyroid cancer.

The older sister has children who have become ill.

- The older sister has the aforementioned daughter, who had thyroid cancer.
- The older sister has a son, who is a candidate for Leukemia because his platelets are very low. He is being monitored by a doctor.

The older sister's daughter was diagnosed with thyroid cancer at age 36. On the night she went into labor, she felt a lump in her throat. Because she was preparing to give birth, she could not immediately have the lump checked. After the baby was born, she had the lump checked by an endocrinologist while she was on maternity leave. The results came back inconclusive. Doctors removed the goiter and assured her not to worry. The results of the biopsy came back positive; the lump was cancerous, doctors removed the second part of her thyroid through the same incision within two weeks. It tested positive as full-blown thyroid cancer. She underwent a body scan and radiation treatment and received radioactive iodine three times. Her baby was four months old at the time, and she was forced to cease breastfeeding. She was forced to stay at home under quarantine during the time she underwent treatment whereas her husband and children, including the four-month-old baby, moved into her mother's home. Later, pre-cancerous cells were detected in her right ovary and both ovaries were removed. She cannot have additional children.



The three women in this family say that their thyroid disease or the medication(s) that they take for their thyroid affect their daily work. They cannot focus or concentrate and sometimes have a difficult time remembering things. However, they have not forgotten the devastation that cancer and thyroid disease has wreaked on their family.

This family's story is not uncommon. Rather, it is a typical narrative of a family in the Tularosa Basin.

#### **4.3.2 Local Oral Histories and Emotional and/or Psychological Effects of the Trinity Test**

One focus group participant told the story of her mother, who lived in the mountains near where the Trinity test was conducted. After the test, her mother suffered from Post-Traumatic Stress Disorder (PTSD). She never slept without the lights on. Her mother was so traumatized by witnessing the bomb blast from afar and believing that the world would end that she turned to alcohol and drugs. The focus group participant expressed that her parents had no knowledge of how to deal with this emotional disorder. She stated that nobody in her family died of cancer before her mother, and she had conducted an extensive genealogy. She believes that the bomb had lasting emotional and psychological effects that affected her entire family.

Another focus group participant discussed his father, who was working for the Pacific Railroad on the day of the Trinity bomb blast. The morning that scientists exploded the bomb, the father was laying down outside taking a break. He expressed how his father always repeated to him that "the sky lit up like daytime," there was a "roar," and "the ground shook." The participant's father's proximity to the blast forced the family to question if this was the reason they had later been affected by disease(s) linked to radiation fallout.

A third focus group participant discussed growing up in the canyon. The family had their own cows and grew their own food. He asked his mother about the explosion, since he was too young to remember the blast. She said that their cattle were covered in ash from the bomb blast. Later, after getting sick himself, the focus group participant spoke with a doctor in Phoenix, Arizona, who informed him that if his parents consumed the



contaminated cattle, which they did, that his genes could have been altered. This resulted in Post-Traumatic Stress Disorder (PTSD) for the focus group participant. He now gets his blood tested every four weeks and has passed the information that he has collected over the years to his son and his siblings. He currently lives in Arizona, but relies heavily on TBDC as an outlet for his frustrations, remarking that without the TBDC, he “would have gone crazy.”

Generally speaking, there is a fear among Tularosa Basin residents, former residents, and their descendants that the question is not “if” they will get cancer but rather “when” they will develop it. Many focus group participants spoke about being afraid.

One 16-year-old focus group participant spoke about not wanting to have children because she is afraid of passing on predisposed genes to her children. She cared for her grandfather while he was dying of cancer, and her grandfather took his last breath in her arms. She says that the smell of certain creams and bandages remind her of his illness and the sacrifices that her family made while he was sick. Her mother, also a focus group participant, spoke about her daughter being “robbed of her childhood” because the daughter is terrified of when she or her other family members will develop cancer—not “if” but “when.”

### **4.3.3 Transgenerational Epigenetic Inheritance**

Transgenerational epigenetic inheritance refers to the belief by some researchers that epigenetic markers like DNA methylation, can be acquired on the DNA of one generation and stably passed on through the gametes (sperm and eggs) to the next generation. While this belief remains controversial about humans, many studies suggest the existence of the inherited transmutation of genes.

In the article “Genetic Radiation Risks: A Neglected Topic in the Low Dose Debate,” Schmitz-Feuerhake, Busby, and Pflugbeil argue: “Genetically induced malformations, cancers, and numerous other health effects in the children of populations who were exposed to low doses of ionizing radiation have been unequivocally demonstrated in scientific investigations” (10). Their work on the manifestation of cancers, specifically, in the children of people who were exposed to low-dose radiation exposure suggests that



transgenerational epigenetic inheritance occurs among populations that have been exposed to atmospheric radiation, such as the populations living in New Mexico near the Trinity site.

Their research demonstrates that British nuclear test veterans who were present at nuclear tests in Australia and the Pacific during the Cold War had children who were born with illnesses or defects, including cancer, malformations, and mental retardation. They report that:

Three studies of nuclear test veterans have shown increases in congenital effects in children and one study has found similar levels of congenital conditions in the grandchildren (Nos. 8-10). The British carried out nuclear weapon tests and activities in Australia (Maralinga) and Christmas Island in the Pacific between 1952 and 1967. More than 20000 [sic] young national servicemen and other military personnel were stationed at the test sites. The sites were contaminated with fission fallout and nanoparticles of uranium and plutonium from the weapons, tritium and carbon-14. Urquhart (61) analysed [sic] data in children from 1147 veteran families. Two hundred and thirty-three out of them had illnesses or defects (cancer, malformations, mental retardation) that could have a genetic origin: one in five families. They registered a 7:1 rate of abnormal children conceived before the tests vs. those conceived after the tests.

These high occurrences of illnesses, one in five families, demonstrates a perceived relationship of being exposed to low-dose radiation during nuclear weapons tests and passing that genetically altered DNA to children.

Their study raises important questions regarding how much exposure is enough to change DNA and then transmit that damaged DNA to offspring. Schmitz-Feuerhake, Busby, and Pflugbeil also state:

In 1984, an exceptionally high level of leukaemia [sic] cases in children and juveniles was reported in Seascale, near the nuclear reprocessing plant in Sellafield in Cumbria, UK. The authors explained this as a hereditary effect, because the fathers of the patients had worked in the plant (64). The authorities argued that the doses were too low. The effect, however, had been described in principle already in experimental studies (65), and also after X-ray diagnostic exposures (Table 3).

The results of this study support the belief that low-dose exposure to nuclear particles can and do cause hereditary effects. Leukemia, or cancer of the blood, is one disease that has been directly linked to radiation exposure during atmospheric tests and is covered by RECA.



## 4.4 Impact Predictions for each Health Determinant

We predict that amending RECA to include the Trinity downwinders would positively impact each health determinant that we have studied.

### 4.4.1 Lack of Access to Health Care

The newly proposed S. 197 would make the Trinity downwinders eligible for “medical benefits in the same manner and to the same extent as an individual eligible to receive medical benefits under section 3629 of the Energy Employees Occupational Illness Compensation Program Act ” (Proposed S. 197). This includes variable compensation up to \$250,000, which is determined based on wage loss, impairment and survivorship. For more on EEOICPA benefits, visit the U.S. Department of Labor website. The [Division of Energy Employees Occupational Illness Compensation \(DEEOIC\) program benefits](#) are explained under the Office of Workers’ Compensation Programs.

### 4.4.2 Economic Impact on Patients and Families

Under the newly proposed S. 197, Trinity downwinders would have the ability to apply for the new amount of \$150,000, which is an increase from the previous \$50,000 award. Downwinder reparation awards of \$150,000 will affect the state’s annual Medicaid budget by lowering the anticipated outlay to low-income Medicaid recipients. States cover some costs, but the amount depends on various factors, including the insured's ability to pay annual premiums. We predict that the cost savings from using RECA medical benefits versus Medicare or Medicaid as first payer would be substantial in New Mexico, with its higher-than-average poverty rate.<sup>20</sup>

### 4.4.3 Generational Trauma

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<sup>20</sup> An article in the February 2, 2017, edition of the *Santa Fe New Mexican* reports: “By the end of the current fiscal year on June 30, Medicaid is expected to cover about 44 percent of the state’s population, or 922,000 residents, including 388,000 enrolled children” (Krasnow, “State grapples with rising Medicaid costs amid ACA uncertainty”).



One oversight in the newly proposed S. 197 is that the Trinity downwinders have not been written into the apology section of RECA. Significantly, the Federal Government has never issued an apology to the people of New Mexico for testing the atomic bomb in their backyard and then walking away. An apology might allow New Mexicans to forgive the Federal government. As it stands, people are hurt and angry. Also, changing the limited period of eligibility from one month— June 30, 1945 to July 31, 1945— to an open-ended period would allow descendants of the original Trinity downwinders to apply to the program, as well. The termination date of 2019 for the RECA trust fund would be extended to a later date of 2045, allowing more people who have suffered generational trauma to apply. Providing annual funds for the RECA trust fund would allow more New Mexicans to apply.



## CHAPTER 5: POTENTIAL OUTCOMES, RECOMMENDATIONS, AND MONITORING PLAN

The TBDC predicts that RECA amendments to include the Trinity downwinders would have a significant impact on the residents of the counties adjacent to the Trinity test site and all New Mexicans.

### 5.1 Potential Positive Outcomes of Amending the Radiation Exposure Compensation Act (RECA)

We predict that if New Mexicans were to be covered by RECA amendments under the category of “downwinders,” New Mexicans, including residents of Lincoln, Otero, Sierra, and Socorro Counties would receive \$150,000 as part of the Compensation program. This money would help relieve the negative economic impact of the many illnesses caused by radiation exposure among Trinity test downwinders. It would also potentially ease the fears of downwinders and their descendants, who are afraid of developing cancer because their genetics have been altered, making them more susceptible to illness. They fear not being able to pay for expensive medical treatments if they do get sick.

An apology, which would potentially be written into Section 1 of RECA, would help alleviate some of the generational trauma felt by many Trinity test downwinders who resent the government for secretly using the people of New Mexico as guinea pigs during the first atmospheric nuclear test.

Finally, acknowledging New Mexicans as downwinders of atmospheric nuclear testing would bring further attention to the substantial numbers of residents with cancer and might even result in building a much-needed treatment facility in southern New Mexico. This would help increase the access to health care and screening for many southern New Mexicans.

### 5.2 Imperative Need to Amend the Radiation Exposure Compensation Act (RECA) during the 2017 Congressional Legislative Session



The current law states that all claims under RECA should be submitted on or before July 9, 2022. This may change with the new amendments; however, the increase in claims filed in combination with an aging downwinder population makes this more timely every year. According to the “FY2017 Budget and Performance Plan” for the RECA Trust Fund,

The youngest individuals exposed to radiation from the fallout of atmospheric nuclear weapons testing turned 50 years old in 2012. Moreover, individuals exposed to ionizing radiation at younger ages have shown a greater risk of contracting these cancers. As cancers express themselves in the affected population, increases of the number of claims in both claimant categories are reasonable assumption. (4)

Financial and legal concerns aside, the potential for \$150,000 of reparations would impact the physical and mental health of a Trinity test downwinder receiving cancer treatment. Because resources are generally scarce, this money could be the difference between life and death for an individual and his/her/their family.

### **5.3 Recommendations to Amend the Radiation Exposure Compensation Act (RECA)**

The proposed Senate Bill 197 (S. 197)—“A bill to amend the Radiation Exposure Compensation Act to improve compensation for workers involved in uranium mining, and for other purposes” and companion House bill would amend the original Radiation Exposure Compensation Act to include New Mexico as a downwinder area. Our recommendations also include the following:

- Issue an apology to the people of New Mexico;
- Provide medical care, similar to that provided to workers under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA);
- Remove the 30-day limited eligibility period and create an open-ended eligibility period for the Trinity downwinders;
- Remove the July 9, 2022, legislative sunset provision and extend the sunset provision to July 9, 2045; and
- Provide recurrent annual funding for the RECA Trust Fund.

### **5.4 Limitations**

No epidemiological studies of resultant health effects have ever been performed on Trinity test downwinders or New Mexico downwinders. The HIA team is hesitant to trust the statistics accessible from the New Mexico Tumor Registry (NMTR). The registry



impacts the health of its citizens by potentially having incomplete or erroneous data on the true incidence of individual cancers, which presents the potential for skewed statistics. Many people travel out of state to Texas, Arizona, or other states for their cancer treatments and are not fully captured in the state's stats. Further, because NMTR shares information with other state institutions such as the University of New Mexico (UNM), along with federal agencies such as the NCI/CDC, New Mexico statistical data is being used for their epidemiological research, further magnifying potential errors.

## **5.5 Monitoring Plan**

Based on our recommendations, the Tularosa Basin Downwinders Consortium (TBDC) plans to monitor Senate Bill 197 (S.197)—“A bill to amend the Radiation Exposure Compensation Act to improve compensation for workers involved in uranium mining, and for other purposes” and the companion House bill as they progress through Congressional committees during the 2017-2018 Congressional legislative session. We also plan to meet regularly with our Congressional delegation to educate them about the HIA findings and recommendations and express the importance of amending RECA to include an apology to the Trinity test downwinders.

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## Appendix A

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### **Tularosa Basin Downwinders Consortium (TBDC) Health Survey**

The TBDC is conducting a health survey of people who've lived in the Tularosa Basin and south central New Mexico counties of Otero, Lincoln, Sierra or Socorro for at least 1 year after the Trinity Site Test Explosion on July 16, 1945. TBDC is a volunteer group of people who are committed to the health of the people who live and have lived in the Tularosa Basin and in New Mexico in general. We're interested in your health history and the health history of your family, friends and neighbors to determine the health effects from the overexposure to radiation after the Trinity Test.

In this survey we will ask you about your medical history and any health problems you have or have had. While we can not guarantee that the information you provide will be entirely confidential every effort will be made to keep as much of your identity and history confidential. We may have to provide names and health histories to government agencies to assist us in building a case for the downwinders designation. This designation will be important as we develop our case for inclusion in the Radiation Exposure Compensation Act (RECA) of 1990 that was developed to compensate people living downwind of the Nevada nuclear test site. The people living downwind of Trinity in New Mexico have never been included in this fund although we were the first downwinders. The fund has paid out more than 2 billion dollars in claims to people living downwind of the Nevada test site and has provided much needed lifetime health coverage to those affected.

A complete history is necessary. Please fill out the entire survey and fill out a survey for yourself and for any family members that may not be able to fill out the form because they are deceased or because they live in other parts of the country. Please use one survey per family member including children etc. Please feel free to make additional copies of the survey if needed and share with family and friends.

WE KNOW THAT COMPLETING THIS SURVEY TAKES TIME AND WE THANK YOU FOR YOUR EFFORTS. If you have questions, need help filling out the form, want additional surveys for family, friends and neighbors or have any other concerns please let us know.

Sincerely,

Tina Cordova  
[tcordova@queston.net](mailto:tcordova@queston.net) 505-897-6787

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Louisa Lopez  
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**BACKGROUND INFORMATION**

Name (please print): \_\_\_\_\_ Female Male

Address: \_\_\_\_\_

Telephone #: \_\_\_\_\_ Email address: \_\_\_\_\_

Date of Birth: \_\_\_\_\_ Place of Birth: \_\_\_\_\_

Years residing in Tularosa Basin/ Socorro, Otero, Lincoln or Sierra County (CIRCLE ONE):  
From: \_\_\_\_\_ To: \_\_\_\_\_

If deceased year of death: \_\_\_\_\_

**MEDICAL HISTORY: Cancer and Tumor**

Have you ever had cancer, or been told by a doctor that you have cancer? If NO, skip this section; if YES, please note which type and indicate year of diagnosis.

Year of Diagnosis \_\_\_\_\_ Year of Diagnosis \_\_\_\_\_

**1. Digestive system**

Stomach \_\_\_\_\_ Liver \_\_\_\_\_

Esophagus \_\_\_\_\_ Mouth \_\_\_\_\_

Colon \_\_\_\_\_ Rectum \_\_\_\_\_

**2. Urinary system**

Bladder \_\_\_\_\_ Kidney \_\_\_\_\_

**3. Lymph System**

Hodgkin's Disease \_\_\_\_\_ non-Hodgkin's Lymphoma \_\_\_\_\_

Burkitt's Lymphoma \_\_\_\_\_ Other Lymphoma \_\_\_\_\_

**4. Respiratory System**

Lung \_\_\_\_\_ Bronchi \_\_\_\_\_

Trachea \_\_\_\_\_ Throat \_\_\_\_\_



Unknowing, Unwilling, and Uncompensated

What Doctor diagnosed your cancer/tumor:

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Where did you receive treatment and what type of treatment did you receive:

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If deceased where did person die (example at home, in hospital in El Paso, etc.)

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**MEDICAL HISTORY: Non-Cancer**

Have you ever been treated for any type of thyroid disease?      Yes \_\_\_\_\_      No \_\_\_\_\_

If Yes were you Hypothyroid (low thyroid) \_\_\_\_\_ or Hyperthyroid (high thyroid) \_\_\_\_\_

What type of treatment did you receive and where?

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Any Other Non-Cancer chronic disease such as chronic lung or kidney disease, heart disease, diabetes, etc.?

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Do you smoke cigarettes and if so how many packs a day and for how long?

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If no, have you ever smoked cigarettes and if so how many packs a day and for how long?

---

Would you be willing to volunteer to assist us in some way?

---

---

Unknowing, Unwilling, and Uncompensated

Do you have any other comments or thoughts you would like to share such as the emotional, psychological or financial toll this has taken on you and your family?

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Signature: \_\_\_\_\_ Date: \_\_\_\_\_

THANK YOU!  
Please return this survey to:  
T. B. D. C.  
C/O Tina Cordova  
7518 2<sup>nd</sup> St. NW  
Albuquerque, New Mexico 87107  
[tcordova@queston.net](mailto:tcordova@queston.net)

To make a monetary donation please send checks to address listed above and make checks payable to CCNS (Concerned Citizens for Nuclear Safety) our fiscal agent.