

# **Trinity Site: 1945–1995. A National Historic Landmark**

White Sands Missile Range Public Affairs Office



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"The effects could well be called unprecedented, magnificent, beautiful, stupendous, and terrifying. No man-made phenomenon of such tremendous power had ever occurred before. The lighting effects beggared description. The whole country was lighted by a searing light with the intensity many times that of the midday sun."

Brig. Gen. Thomas Farrell

## Radiation at Trinity Site

In deciding whether to visit ground zero at Trinity Site, the following information may prove helpful to you. Radiation levels in the fenced, ground zero area are low. On an average the levels are only 10 times greater than the region's natural background radiation. A one-hour visit to the inner fenced area will result in a whole body exposure of one-half to one milliroentgen.

To put this in perspective, a U.S. adult receives an average exposure of 90 milliroentgens every year from natural and medical sources. For instance, the Department of Energy says we receive between 35 and 50 milliroentgens every year from the sun and from 20 to 35 milliroentgens every year from our food. Living in a brick house adds 50 milliroentgens of exposure every year compared to living in a frame house. Finally, flying coast to coast in a jet airliner gives an exposure of between three and five milliroentgens on each trip.

Although radiation levels are low, some feel any extra exposure should be avoided. The decision is yours. It should be noted that small children and pregnant women are potentially more at risk than the rest of the population and are generally considered groups who should only receive exposure in conjunction with medical diagnosis and treatment. Again, the choice is yours.

At ground zero, Trinitite, the green, glassy substance found in the area, is still radioactive and must not be picked up.

Typical radiation exposures for Americans Per The National Council on Radiation Protection

On hour at ground zero = 1/2 mrem

Cosmic rays from space = 40 mrem at sea level per year

Radioactive minerals in rocks and soil = 55 mrems per year

Radioactivity from air, water, and food = anywhere from 20 to 400 mrem per year

About 22 mrem per chest X-ray and 900 mrem for whole-mouth dental X-rays

Smoking one pack of cigarettes a day for one year = 40 mrem

Miscellaneous such as watch dials and smoke detectors = 2 mrem per year

## How to Get to Trinity Site

Trinity Site, where the world's first atomic bomb was exploded in 1945, is normally open to the public twice a year—on the first Saturday in April and October.

Trinity is located on the northern end of the 3,200–square–mile White Sands Missile Range, N.M., between the towns of Carrizozo and Socorro, N.M. There are two ways of entering the restricted missile range on tour days.

Visitors can enter through the range's Stallion Range Center which is five miles south of Highway 380. The turnoff is 12 miles east of San Antonio, N.M. , and 53 miles west of Carrizozo, N.M. The Stallion gate will be open 8 a.m. to 2 p.m. Visitors arriving at the gate between those hours will receive handouts and will be allowed to drive unescorted the 17 miles to Trinity Site. The road is paved and marked.

The other way of entering the missile range is by travelling with a caravan sponsored by the Alamogordo (N.M.) Chamber of Commerce. The caravan forms at the Otero County Fairgrounds in Alamogordo and leaves at 8 a.m. Visitors entering this way will travel as an escorted group with military police to and from Trinity Site. The drive is 170 miles round trip. There are no service station facilities on the missile range. The caravan is scheduled to leave Trinity Site at 12:30 p.m. for the return to Alamogordo. The caravan may leave later if there is a large number of vehicles in the returning caravan.

In 1995, an additional open house will be conducted on July 16, the 50th anniversary of the Trinity test. Visitors may enter the missile range through the Stallion Range Center gate from 5 to 11 a.m. There will be no caravan leaving from Alamogordo, N.M., for this event. The early hours will allow visitors to be on–site at 5:29:45 a.m., the time the Trinity Site detonation occurred, and should help visitors avoid the 100–plus degree afternoon temperatures common here in July.

Included on the Trinity Site tour is Ground Zero where the atomic bomb was placed on a 100–foot steel tower and exploded on July 16, 1945. A small monument now marks the spot. Visitors also see the McDonald ranch house where the world's first plutonium core for a bomb was assembled. The missile range provides historical photographs and a Fat Man bomb casing for display. There are no ceremonies or speakers.

Portable toilet facilities are available on site. Hot dogs and sodas are sold at the parking lot. Cameras are allowed at Trinity Site, but their use is strictly prohibited anywhere else on White Sands Missile Range.

For more information, contact the White Sands Missile Range Public Affairs Office at (505) 678–1134/1700.

## **Trinity Site National Historic Landmark**

Trinity Site is where the first atomic bomb was tested at 5:29:45 a.m. Mountain War Time on July 16, 1945. The 19 kiloton explosion not only led to a quick end to the war in the Pacific but also ushered the world into the atomic age. All life on Earth has been touched by the event which took place here.

The 51,500–acre area was declared a national historic landmark in 1975. The landmark includes base camp, where the scientists and support group lived; ground zero, where the bomb was placed for the explosion; and the McDonald ranch house, where the plutonium core to the bomb was assembled. On your visit to Trinity Site you will be able to see ground zero and the McDonald ranch house. In addition, on your drive into the Trinity Site area you will pass one of the old instrumentation bunkers which is beside the road just west of ground zero.

## **The Manhattan Project**

The story of Trinity Site begins with the formation of the Manhattan Project in June 1942. The project was given overall responsibility of designing and building an atomic bomb. At the time it was a race to beat the Germans who, according to intelligence reports, were building their own atomic bomb.

Under the Manhattan Project three large facilities were constructed. At Oak Ridge, Tenn., huge gas diffusion and electromagnetic process plants were built to separate uranium 235 from its more common form, uranium 238. Hanford, Wash. became the home for nuclear reactors which produced a new element called plutonium. Both uranium 235 and plutonium are fissionable and can be used to produce an atomic explosion.

Los Alamos was established in northern New Mexico to design and build the bomb. At Los Alamos many of the greatest scientific minds of the day labored over the theory and actual construction of the device. The group was led by Dr. J. Robert Oppenheimer who is credited with being the driving force behind building a workable bomb by the end of the war.

## The Theory

Los Alamos scientists devised two designs for an atomic bomb—one using the uranium and another using the plutonium. The uranium bomb was a simple design and scientists were confident it would work without testing. The plutonium bomb worked by compressing the plutonium into a critical mass which sustains a chain reaction. The compression of the plutonium ball was to be accomplished by surrounding it with lens-shaped charges of conventional explosives. They were designed to all explode at the same instant. The force is directed inward, thus smashing the plutonium from all sides.

In an atomic explosion, a chain reaction picks up speed as atoms split, releasing neutrons plus great amounts of energy. The escaping neutrons strike and split more atoms, thus releasing still more neutrons and energy. In a nuclear explosion this all occurs in a millionth of a second with billions of atoms being split.

Project leaders decided a test of the plutonium bomb was essential before it could be used as a weapon of war. From a list of eight sites in California, Texas, New Mexico and Colorado, Trinity Site was chosen as the test site. The area already was controlled by the government because it was part of the Alamogordo Bombing and Gunnery Range which was established in 1942. The secluded Jornado del Muerto was perfect as it provided isolation for secrecy and safety, but was still close to Los Alamos.

## Building a test site

In the fall of 1944 soldiers started arriving at Trinity Site to prepare for the test. Marvin Davis and his military police unit arrived from Los Alamos at the site on Dec. 30, 1944. The unit set up security checkpoints around the area and had plans to use horses to ride patrol. According to Davis the distances were too great and they resorted to jeeps and trucks for transportation. The horses were sometimes used for polo, however. Davis said that Capt. Bush, base camp commander, somehow got the soldiers real polo equipment to play with but they preferred brooms and a soccer ball.

Other recreation at the site included volleyball and hunting. Davis said Capt. Bush allowed the soldiers with experience to use the Army rifles to hunt deer and pronghorn. The meat was then cooked up in the mess hall. Leftovers went into soups which Davis said were excellent.

Of course, some of the soldiers were from cities and unfamiliar with being outdoors a lot. Davis said he went to relieve a guard at the Mockingbird Gap post and the soldier told Davis he was surprised by the number of "crawdads" in the area considering it was so dry. Davis gave the young man a quick lesson on scorpions and warned him not to touch.

Throughout 1945 other personnel arrived at Trinity Site to help prepare for the test. Carl Rudder was inducted into the Army on Jan. 26, 1945. He said he passed through four camps, took basic for two days and arrived at Trinity Site on Feb. 17. On arriving he was put in charge of what he called the "East Jesus and Socorro Light and Water Company." It was a one-man operation—himself. He was responsible for maintaining generators, wells, pumps and doing the power line work.

A friend of Rudder's, Loren Bourg, had a similar experience. He was a fireman in civil life and ended up trained as a fireman for the Army. He worked as the station sergeant at Los Alamos before being sent to Trinity Site in April 1945. In a letter Bourg said, "I was sent down here to take over the fire prevention and fire department. Upon arrival I found I was the fire department, period."

As the soldiers at Trinity Site settled in they became familiar with Socorro. They tried to use the water out of the ranch wells but found it so alkaline they couldn't drink it. In fact, they used Navy salt-water soap for bathing. They hauled drinking water from the fire house in Socorro. Gasoline and diesel was purchased from the Standard bulk plant in Socorro.

According to Davis, they established a post office box, number 632, in Socorro so getting their mail was more convenient. The trips into town also offered them the chance to get their hair cut in a real barbershop. If they didn't use the shop, Sgt. Greyslock used horse clippers to trim their hair.

## Jumbo

The bomb design to be used at Trinity Site actually involved two explosions. First there would be a conventional explosion involving the TNT and then, a fraction of a second later, the nuclear explosion, if a chain reaction was maintained. The scientists were sure the TNT would explode, but were initially unsure of the plutonium. If the chain reaction failed to occur, the TNT would blow the very rare and dangerous plutonium all over the countryside.

Because of this possibility, Jumbo was designed and built. Originally it was 25 feet long, 10 feet in diameter and weighed 214 tons. Scientists were planning to put the bomb in this huge steel jug because it could contain the TNT explosion if the chain reaction failed to materialize. This would prevent the plutonium from being lost. If the explosion occurred as planned, Jumbo would be vaporized.

Jumbo was brought to Pope, N.M., by rail and unloaded. A specially built trailer with 64 wheels was used to move Jumbo the 25 miles to Trinity Site.

As confidence in the plutonium bomb design grew it was decided not to use Jumbo. Instead, it was placed in a steel tower about 800 yards from ground zero. The blast destroyed the tower, but Jumbo survived intact.

Today Jumbo rests at the entrance to ground zero so all can see it. The ends are missing because, in 1946, the Army detonated eight 500–pound bombs inside it. Because Jumbo was standing on end, the bombs were stacked in the bottom and the asymmetry of the explosion blew the ends off.

To calibrate the instruments which would be measuring the atomic explosion and to practice a countdown, the Manhattan scientists ran a simulated blast on May 7. They stacked 100 tons of TNT onto a 20–foot wooden platform just southeast of ground zero. Louis Hemplemann inserted a small amount of radioactive material from Hanford into tubes running through the stack of crates. The scientists hoped to get a feel for how the radiation might spread in the real test by analyzing this test. The explosion destroyed the platform, leaving a small crater with trace amounts of radiation in it.

## Bomb Assembly

On July 12 the two hemispheres of plutonium were carried to the George McDonald ranch house just two miles from ground zero. At the house, Brig. Gen. Thomas Farrell, deputy to Maj. Gen. Leslie Groves, was asked to sign a receipt for the plutonium. Farrell later said, "I recall that I asked them if I was going to sign for it shouldn't I take it and handle it. So I took this heavy ball in my hand and I felt it growing warm, I got a certain sense of its hidden power. It wasn't a cold piece of metal, but it was really a piece of metal that seemed to be working inside. Then maybe for the first time I began to believe some of the fantastic tales the scientists had told about this nuclear power."

At the McDonald ranch house the master bedroom had been turned into a clean room for the assembly of the bomb core. According to Robert Bacher, a member of the assembly team, they tried to use only tools and materials from a special kit. Several of these kits existed and some were already on their way to Tinian, the island in the Pacific which was the base for the bombers. The idea was to test the procedures and tools at Trinity as well as the bomb itself.

At one minute past midnight on Friday, July 13, the explosive assembly left Los Alamos for Trinity Site. Later in the morning, assembly of the plutonium core began. According to Raemer Schreiber, Robert Bacher was the advisor and Marshall Holloway and Philip Morrison had overall responsibility. Louis Slotin, Boyce McDaniel and Cyril Smith were responsible for the mechanical assembly in the ranch house. Later Holloway was responsible for the mechanical assembly at the tower.

In the afternoon of the 13th the core was taken to ground zero for insertion into the bomb mechanism.

The bomb was assembled under the tower on July 13. The plutonium core was inserted into the device with some difficulty. On the first try it stuck. After letting the temperatures of the plutonium and casing equalize the core slid smoothly into place. Once the assembly was complete many of the men took a welcome relief and went swimming in the water tank east of the McDonald ranch house.

The next morning the entire bomb was raised to the top of the 100 foot steel tower and placed in a small shelter. A crew then attached all the detonators and by 5 p.m. it was complete.

## The test

Three observation points were established at 10,000 yards from ground zero. These were wooden shelters protected by concrete and earth. The south bunker served as the control center for the test. The automatic firing device was triggered from there as key men such as Dr. Robert Oppenheimer, head of Los Alamos, watched. None of the manned bunkers are left.

Many scientists and support personnel, including Gen. Leslie Groves, head of the Manhattan Project, watched the explosion from base camp which was ten miles southwest of ground zero. All the buildings at base camp were removed after the test. Most visiting VIPs watched from Compania Hill, 20 miles northwest of ground zero.

The test was scheduled for 4 a.m. July 16, but rain and lightning early that morning caused it to be postponed. The device could not be exploded under rainy conditions because rain and winds would increase the danger from radioactive fallout and interfere with observation of the test. At 4:45 a.m. the crucial weather report came through announcing calm to light winds with broken clouds for the following two hours.

At 5:10 the countdown started and at 5:29:45 the device exploded successfully. To most observers the brilliance of the light from the explosion—watched through dark glasses—overshadowed the shock wave and sound that arrived later.

Hans Bethe, one of the contributing scientists, wrote "it looked like a giant magnesium flare which kept on for what seemed a whole minute but was actually one or two seconds. The white ball grew and after a few seconds became clouded with dust whipped up by the explosion from the ground and rose and left behind a black trail of dust particles."

Joe McKibben, another scientist, said, "We had a lot of flood lights on for taking movies of the control panel. When the bomb went off, the lights were drowned out by the big light coming in through the open door in the back."

Others were impressed by the heat they immediately felt. Military policeman Davis said, "The heat was like opening up an oven door, even at 10 miles." Dr. Phillip Morrison said, "Suddenly, not only was there a bright light but where we were, 10 miles away, there was the heat of the sun on our faces....Then, only minutes later, the real sun rose and again you felt the same heat to the face from the sunrise. So we saw two sunrises."

## **After the explosion**

Although no information on the test was released until after the atomic bomb was used as a weapon against Japan, people in New Mexico knew something had happened. The shock broke windows 120 miles away and was felt by many at least 160 miles away. Army officials simply stated that a munitions storage area had accidentally exploded at the Alamogordo Bombing Range.

The explosion did not make much of a crater. Most eyewitnesses describe the area as more of a small depression instead of a crater. The heat of the blast did melt the desert sand and turn it into a green glassy substance. It was called Trinitite and can still be seen in the area. At one time Trinitite completely covered the depression made by the explosion. Afterwards the depression was filled and much of the Trinitite was taken away by the Nuclear Energy Commission.

To the west of the monument is a low structure which is protecting an original portion of the crater area. Trinitite is visible through openings in the roof.

## **It's the Schmidt house**

The George McDonald ranch house sits within an 85'x85' low stone wall. The house was built in 1913 by Franz Schmidt, a German immigrant, and an addition was constructed on the north side in the 1930's by the McDonalds. There is a display about the Schmidt family in the house during each open house.

The ranch house is a one-story, 1,750 square-foot building. It is built of adobe which was plastered and painted. An ice house is located on the west side along with an underground cistern which stored rain water running off the roof. At one time the north addition contained a toilet and bathtub which drained into a septic tank northwest of the house.

There is a large, divided water storage tank and a Chicago Aeromotor windmill east of the house. The scientists and support people used the north tank as a swimming pool during the long hot summer of 1945. South of the windmill are the remains of a bunkhouse and a barn which was part garage. Further to the east are corrals and holding pens. The buildings and fixtures east of the house have been stabilized to prevent further deterioration.

The ranch was abandoned in 1942 when the Alamogordo Bombing and Gunnery Range took over the land to use in training World War II bombing crews. The house stood empty until the Manhattan Project support personnel arrived in early 1945.

Inside the house the northeast room (the master bedroom) was designated the assembly room. Work benches and tables were installed. To keep dust and sand out of instruments and tools, the windows were covered with plastic. Tape was used to fasten the edges of the plastic and to seal doors and cracks in the walls.

The explosion, only two miles away, did not significantly damage the house. Most of the windows were blown out, but the main structure was intact. Years of rain water dripping through holes in the roof did much more damage. The barn did not do as well. During the Trinity test the roof was bowed inward and some of the roofing was blown away. The roof has since collapsed.

The house stood empty and deteriorating until 1982 when the U.S. Army stabilized the house to prevent any further damage. Shortly after, the Department of Energy and U.S. Army provided the funds for the National Park Service to completely restore the house. The work was done in 1984. All efforts were directed at making the house appear as it did on July 12, 1945.

## Afterwards

The story of what happened at Trinity Site did not come to light until after the second atomic bomb was exploded over Hiroshima, Japan, on August 6. President Truman made the announcement that day. Three days later, August 9, the third atomic bomb devastated the city of Nagasaki, and on August 14 the Japanese surrendered.

Trinity Site became part of what was then White Sands Proving Ground. The proving ground was established on July 9, 1945, as a test facility to investigate the new rocket technology emerging from World War II. The land, including Trinity Site and the old Alamogordo Bombing Range, came under the control of the new rocket and missile testing facility.

Interest in Trinity Site was immediate. In September 1945 press tours to the site started. One of the famous photos of ground zero shows Robert Oppenheimer and General Leslie Groves surrounded by a small group of reporters as they examine one of the footings to the 100 foot tower on which the bomb was placed. That picture was taken Sept. 11. The exposed footing is still visible at ground zero. On Sept. 15–17, George Cremeens, a young radio reporter from KRNT in Des Moines, visited the site with soundman Frank Lagouri. They flew over the crater and interviewed Dr. Kenneth Bainbridge, Trinity test director, and Capt. Howard Bush, base camp commander.

Back in Iowa, Cremeens created four 15–minute reports on his visit which aired Sept. 24, 26, 27 and 29. A 15–minute composite was made and aired on the ABC Radio Network. For his work Cremeens received a local Peabody Award for "Outstanding Reporting and Interpretation of the News."

At first Trinity Site was encircled with a fence and radiation warning signs were posted. The site remained off–limits to military and civilian personnel of the proving ground and closed to the public.

In 1952 the Atomic Energy Commission let a contract to clean up the site. Much of the Trinitite was scraped up and buried. In September 1953 about 650 people attended the first Trinity Site open house. A few years later a small group from Tularosa visited the site on an anniversary of the explosion to conduct a religious service and prayers for peace. Similar visits have been made annually in recent years on the first Saturday in October.

In 1967 the inner oblong fence was added. In 1972 the corridor barbed wire fence which connects the outer fence to the inner one was completed. Jumbo was moved to the parking lot in 1979.

Visits to the site are now made in April and October because it is generally so hot in July on the Jornada del Muerto.

## White Sands Missile Range

White Sands Missile Range has developed from a simple desert testing site for the V-2 into one of the most sophisticated test facilities in the world. The mission of White Sands Missile Range begins with a customer—a service developer, or another federal agency, which is ready to find out if engineers and scientists have built something which will perform according to job specifications. It ends when an exhaustive series of tests has been completed and a data report has been delivered to the customer.

Between the beginning and the end of the test program, be it the Army Tactical Missile System or newly designed automobiles, range employees are involved in every operation connected with the customer and his product. The range can and does provide everything from rat traps to telephones, from equipment hoists and flight safety to microsecond timing.

We shake, rattle and roll the product, roast it, freeze it, subject it to nuclear radiation, dip it in salt water and roll it in the mud. We test its paint, bend its frame and find out what effect its propulsion material has on flora and fauna.

In the end, if it's a missile, we fire it, record its performance and bring back the pieces for post mortem examination. All test data is reduced and the customer receives a full report.

For more information on Trinity Site or White Sands Missile Range contact:

Public Affairs Office (STEWS-PA) White Sands Missile Range White Sands Missile Range, N.M.  
88002-5047

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