We Were Trapped by Radioactive Fallout

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The Wetokian *by Dr. John C. Clark* **Fall**
Web Issue *as told to Robert Cahn* **1999**

Here, revealed for the first time, is how nine scientists were caught 20 miles from ground zero when the biggest H-bomb of all time went off. This is their chilling story. Saturday Evening Post, July 1957

. . . by Dr. John C. Clark as told by Robert Cahn

May, 1956: Fireball over Bikini. This is what America's first H-bomb blast looked like from a plane 12,000 feet up and 50 miles away.

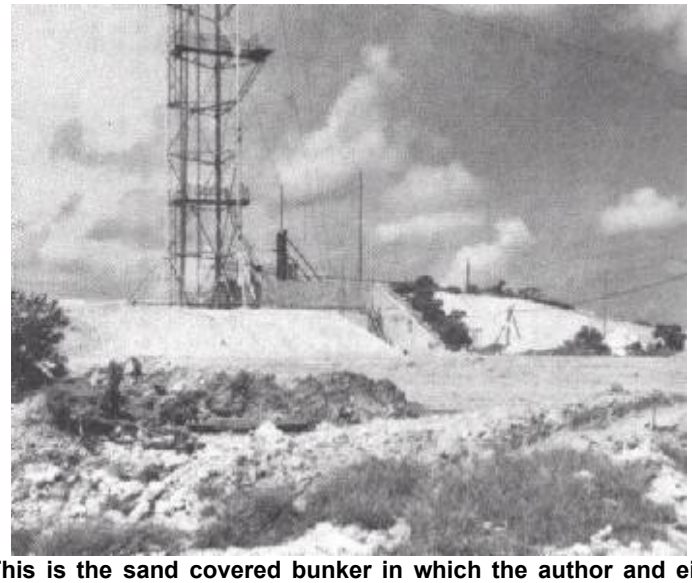
When we locked open the main firing switch in the control room before leaving to arm the H-bomb that February day at Bikini in 1954, I had no feeling that this one would be any different from the more than forty other nuclear test shots in which I had participated. Since it was a thermonuclear bomb of a relatively large predicted yield which we were testing, we had tried to figure out in advance all the possibilities of danger and to make allowances for all eventualities. But this is not easy when one is concerned with a device which produces an explosive force roughly equivalent to 15,000,000 tons of TNT --- 1000 times more powerful than the Hiroshima atom bomb.

The energy released by the thermonuclear blast -- which we call the "yield" -- could not be predetermined with absolute accuracy. Nor could we tell beforehand exactly how extensive the air-wave and tidal-wave effects would be or the precise amount and distribution of the "fallout"-- the radioactive particles from the nuclear cloud which drop back to earth. In the business of testing nuclear devices there are always a few unknowns.

The temperature was in the high eighties, the sky was clear and there was just a slight breeze blowing as we got into the helicopters for the flight to the shot island approximately twenty miles northwest, at the other end of Bikini atoll. It was a perfect day for the end of February--far

different from the weather at some places Stateside. All our extensive preparations for this first shot in Operation Castle had come off on schedule and we contemplated no trouble ahead. Little did we realize that within eighteen hours we would become unsolicited human guinea pigs during the strangest and most hazardous effects ever experienced from an American nuclear test.

After clearing the coconut palms through which our landing strip had been cut, I looked down at our sturdy control blockhouse. It certainly seemed out of place among the palms and pandanuses on our tiny tear-drop-shaped island. Coral sand covered most of the roof--sand which the radiation experts said would help protect anybody inside the building from stray fallout radiation.



This is the sand covered bunker in which the author and eight others were trapped by the deadly fallout in Operation Castle. They were rescued by helicopter.

The structure had also been sealed to withstand up to at least a five-foot tidal wave and built of reinforced concrete to resist the overpressure and underpressure effects expected from the blast. It certainly looked secure enough even to satisfy those who had argued that we would be safer if the firing were controlled from a greater distance. But inasmuch as our control island, Enyu, was the most distant spot on the atoll from ground zero, to go farther would have necessitated firing from a ship. And we wanted to avoid the more complicated ship-controlled firing if at all possible.

It was now shortly after noon and as our Marine helicopter pilot headed north over the atoll, I could see the last few supply ships pulling away from Enyu. The operational plan called for all ships to be safely out to sea by the time we armed the gadget. We hoped to have the arming completed and be back at the control island in time for the helicopters to return to their mother ships before dark.

As we headed across the lagoon to the first of our instrument stations, the string of islands and reefs which comprise Bikini atoll looked like so many beads on a necklace. The largest islands are one to two miles long and at their widest are less than 800 yards across. Others are no more than reefs or sandspits. In a few minutes we dropped down onto one of the small islands. While Herb Grier, an electrical engineer from Boston, checked on some of the recording instruments, I locked open a part of the circuitry in a blast-proof bunker. The Commander of the firing party must lock open all the switches in the firing circuits with padlocks and keep the only key. It's not that we don't trust others. But in the business of arming a thermonuclear bomb, you must be absolutcly certain that no circuits are closed at the time of arming.

About two o'clock, after making a few more stops to check on instruments and to lock open switches, we arrived at the shot site. With me were Grier and Barney O'Keefe, both of the Boston firm of Edgerton, Germeshausen and Grier, electrical contractors to the Atomic Energy Commission. Already there, having flown up in another helicopter, was Dr. Gaelen Felt, one of the top young scientists from Los Alamos.

Inside the blockhouse: Here, only 20 miles from ground zero, Dr. Felt (Right) and an assistant man test devices. Radiation from the 1954 Blast penetrated this room.

Felt, Grier and O'Keefe had specific duties concerned with the numerous optical and electronic experiments which are always co-ordinated in the test of a nuclear device. My job was to check on everything at the shot site, and then, when all was in order, to arm the bomb.

We were almost finished with the checking when Gaelen discovered helium, used in optical experiments, leaking from one of the key setups. Some rapid calculations disclosed that by shot time the next morning there would not be sufficient pressure left in the tanks to carry out the experiment. I radioed the information to Dr. Alvin C. Graves, scientific deputy to the task-force commander, who was aboard the command ship. Without this experiment, the test would not be held.

We soon discovered that we could not fix the leaks in the short time left. But we came up with another solution to the problem. If we delayed the arming procedure for seven hours and opened the valves at the last possible moment, there would still be enough helium for the experiment. We did not desire to return after dark because our island landing mat had no lights. However, it was either set back the arming or postpone the test and Doctor Graves gave us the go-ahead for our emergeney plan.

We sat around until dark taking it easy while the whirly-bird pilots went off to a nearby construction site and scrounged some food that had been left there by the workmen. The temperature, which varies less than ten degrees night and day, was still in the eighties. Shortly before eleven P.M. we opened the valves of the helium tanks. I then requested permission from the command ship to arm the bomb. Before the final connections are made, a check must be made to determine that no other personnel are in or near the shot island. We are pretty darn sure the bomb won't go off when we arm it, but with the complex circuitry involved there is always the one chance in a million that something might go wrong.

Barney and Herb accompanied me to the artificial sandspit which was ground zero, This "island" had been dredged up out of the coral sand so that it could be in the most advantageous position for the shot. As a safety precaution, we always have someone else along to check every action of

the person arming the device just to make doubly certain that each step is done correctly. Much of the work in an atomic test can be done by automation, but for all the experimental bomb tests so far we have done the arming by hand.

All went according to plan, however, and I made the final connections which armed thc bomb. We quickly got into the helicopters and headed back, retracing our path to close the switches I had lockcd open earlier in the day. The pilots could easily follow the white-coral shoreline and we got back to Enyu about midnight. The men who had been checking things at the control point took our places in the helicopters, which then scooted off to join their ships, already headed away from the shot site.

There were nine of us remaining in the blockhouse. In addition to Doctor Felt, O'Keefe, Grier and myself, there were Dr. Harold Stewart, a scientist from the Naval Research Laboratory; Lt. Douglas Cochrane, a radio expert; John L. Sanderson, of Holmes & Narver, Los Angeles contractors who did the construction work • and two radio technicians, Airman First Class Gerald Scarpino and Master Sergeant Alton Greene.

We made our last-minute checkouts of circuits and then waited for the final weather reports from the command ship. Around three A.M.-- zero hour was scheduled for shortly before daybreak-- the scientific director radioed, "We have just had the weather briefing and we agreed to continue. So go ahead and start the count-down."

Herb Grier, who was making the time announcements, waited for the tone from WWV, thc world-wide standard-time station. "It is now minus two hours," announced Grier at the beep of the signal. Almost 100 miles away, on small islands in the atolls of Rongelap, Rongerik and Utirik, technicians from an American military weather group checked their watches and recording devices. At other points on the ocean, personnel on ship instrumentation stations synchronized their time settings. And in the air, pilots and navigators coordinated with our announcement to make certain they would be at their correct position at shot time. Other aircraft had already completed search flights in the area and had seen no stray ships. Apparently, as we found out later, they somehow failed to spot the little Japanese trawler Fukuryu Maru--the Fortunate Dragon--fishing about seventy miles off our shot island.

At minus one hour we started our final preparations. I told John Sanderson to button up the generators in a nearby concrete bunker and to secure the control building. After closing the doors to the structure housing the generators, Sanderson climbed a ladder outside our blockhouse to put metal plates and gaskets over the air-conditioning vents. He then entered the blockhouse and sealed the submarine hatch which had been installed as our only door and which was completely watertight and blastproof.

At H hour minus fifteen minutes I told Grier to push the button on the automatic sequence timer. Contrary to popular belief, we don't push a button to set off the bomb. Everything is done electrically by the sequence timer, although up until the last second I can pull a switch to stop the bomb from going off. Also there are "no-go" devices built into the circuitry which automatically prevent the detonation-- should any of the primary experiments not be ready to function properly. There are hundreds of experiments conducted during most nuclear detonations, but we

usually limit those which can lock out a detonation to four or five. However, some of these four or five circuits are closed so late that even at the last second we are not sure that a no-go device won't halt the test.

Those last few scconds in the control room are always quite tense. We keep watching the control panel, where lights flash from red to green to show when experiments and circuits are rcady to operate. Somc remote-controlled cameras near the bomb are not turned on until between minus three quarters of a second and minus a half second. We would rather not have to rely on such delicate timing, but these ultra-high-speed cameras work at a rate of over l,000,000 frames a second and require split-second control.

The purpose of nuclear detonations is always to obtain experimental data, and it would be a waste of money and months of scientific effort if the bomb went off and the recording equipment was not in complete readiness.

After the sequence timer had been started, we all gathered in the control room for a final briefing. I requested that all who were not needed in the control room should stand in the hall. I told them that although we expected no difficulty, there would he a ground shock shortly afer the bomb went off. This would be followed by the air shock wave, which, at twenty miles' distance, would probably do no great damage. Finally, there was the possibility of a tidal wave sweeping over the building. If it came, it was due at about H plus seven minutes. I told them I had agreed with Doctor Graves that, inasmuch as we had no observation winldows, we would wait until H plus fifteen minutes before "unbuttoning" the building, to make absolutely sure we were not under water.

At H minus ten minutes, Grier, O'Keefe and Lieutenant Cochrane manned posts at the control panel. Hal Stewart was in a nearby room where he had his spectrographic instruments, and I stayed in the center of the control room.

"At the next tone it will be H minus one minute," announced Grier a few minutes later.

"Thirty seconds," announced Grier. "Fifteen...." All exccpt two of the lights were green. "Ten . . . nine . . . eight . . . seven ... six ... five...." All was absolutely quiet except for the soft whining of the sequence timer. "Four . . . three . . . two . . . one . . . Zero."

I looked at the panel; all the lights were green, we knew the bomb should have detonated.

"How did it go Al?" I called on the radio to Doctor Graves, forty miles away on the command ship.

"It's a good one," he answered.

Inside our blockhouse we still had no physical evidence that anything had happened, but we braced ourselves against a possible sharp ground shock.

It came--but not as expected. Less than twenty seconds after Zero the entire building started slowly rocking in an indescribable way. I grabbed the side of the control panel for support. Some of the men just sat down on the floor. I had been in earthquakes before, but never anything like

this. It lasted only a few seconds, but just as we were breathing easier, another ground shock hit us, with the same undulating motion. Then, a minute later, came the air blast. First the overpressure, then the sucking out by the underpressure. The concrete building creaked, but stayed firm. A few yards away, as we found out later, frame buildings had been blown down by the hurricane winds from the blast.

Immediately after thc air blast. Felt noticed some water coming in through the conduits behind the control panel. And about the same time water in the lavatory started shooting up to the ceiling. I radioed the information to Doctor Graves who was as perplexed as we were. Water effects were not expected for six more minutes. We later found out that this water had been forced up from the lagoon by the overpressurc created from the air blast, and had come in through pipes and conduits.

For the next few minutes nothing happened. We waited for any possible tidalwave effect.

H plus seven minutes went by. Nothing happened. H plus ten minutes. Finally, at H plus fourteen. I radioed Doctor Graves and told him we would open the door. Cautiously, Sanderson moved the steel plate to make sure we were not under water. When nothing happend, he opened the door. Everything was calm outside.

While I stayed inside to man the radio, the others went out to look at the mushroom." In a couple of minutes, Grier came back to relieve me at the radio and I went outside, taking along a Geiger counter. The shot cloud had spread out and was pure white. It was an awesome sight. I casually placed the radiation counter on top of a fence outside the door and turned away to talk to Gaelen Felt, who was pointing out that the blast had torn the doors open on his instrument trailers nearby. All of a sudden I noted that the radiation meter was already reading eight milliroentgen. That meant we were receiving radiation at the rate of 8/1000 of a roentgen per hour, far less than would be received from an ordinary chest X ray.

While we watched, the counter went up to twenty milliroentgen, then to forty. While this was not yet a dangerous amount of radioactivity, there should not have been any radiation at the distance we were from the bomb blast. It could mean only one thing: we were already getting fallout. We could hardly believe it. The wind was supposed to take the fallout in almost an opposite direction. But our Geiger counters were registering radioactivity, and counters are usually accurate.

After the counter reached fifty milliroentgen, I had to turn the knob to change scales. The pointer kept climbing. I called for everyone to get inside. It still was far below dangerous radiation levels, but we had no idea how fast and how much it might increase. A dose of 75 to 125 roentgen received in a short interval may produce nausea and other symptoms of radiation sickness. About 450 roentgen might be fatal.

By the time we were back in the blockhouse, the reading near the door was one roentgen, and in the control room it was about twenty milliroentgen. I radioed Doctor Graves, who checked with the weather boys. No one could understand why we should be getting fallout, but were. Of course it was a known fact that winds at higher altitudes sometimes blow in opposite directions and could shear the bomb cloud as it passed through diferent levels. But no such opposing winds had been predicted.

A few minutes later I again called Doctor Graves on the radio.

"The radiation is building up pretty fast, Al," I reported. "Inside by the door it now reads ten r.

The level here in the Control room is fifty milli-r."

We then discussed the possibility of sending in helicopters to take us to the ships. But Doctor Graves rightly decided that much as he would like to get us off the island, at the rate the radiation was building up outside, it was too risky for all concerned to attempt a helicopter rescue.

We agreed it was safer now to be inside our sand-covered blockhouse than to be outside in the intense, direct radiation trom the fallout even for the short time a rescue operation might take. Of course we had no idea how much the radiation might build up inside the blockhouse. But it became increasingly clear that we had no choice. We were trapped.

In a few minutes the radiation level in the control room reached 100 milliroentgen. This was above a safe level in which to stay for any great length of time. At this point we did not know how long we would have to stay in the the building, so we decided to see if there might be a safer place to which we could retreat.

Felt and O'Keefe first checked Stewart's room near the door. They found the radiation level there many times higher than in the control room. They then went to the radio room across the hall from the control room. Here also the level was too high for safety. There were only three rooms left--a communications room, my small office and a data-processing room. I breathed a sigh of relief when Felt told me that the level in this data room was only ten milliroentgen. Fortunately, considerably more sand had been piled on top of the part of the building covering the fifteen-by-twenty-foot data-processing room, and the sand was shielding us from the radiation.

I advised the command ship of our situation. I told them that we had found a room in the blockhouse which seemed perfectly safe unless the fallout level outside got much higher. At the rate of ten milliroentgen per hour we could remain for days without harmful effects. I did advise them, however, that we would man the radio in the control room only every fifteen minutes.

I told the men to make themselves as comfortable as they could in the data room. There were a few Army cots in the building and these were moved into this room. It was now about H plus one hour and I was most concerned as to what was happening to the radiation level outside. I took the radiation meter, opened the door and gingerly placed it outside at arm's length for a quick reading. It read forty roentgen. I quickly closed the door.

Shortly after we had gone into the data room, Hal Stewart asked permission to get his spectroscopic plates and film out of his room. If he did not get them at once, all his test results would be ruined. We figured out that he could stay for eight minutes without getting too much radiation, so I said go ahead. He rushed into the room, wrapped the plates and film in a black cloth, and got back in just under seven minutes.

We were not exactly a happy bunch as we sat around in that small back room. We had been forced to turn off the air conditioner because it brought in fallout particles from outside. The entire building soon got hot and sticky. Only a few yards away in the construction camp were steaks we had planned on having breakfast. Instead, we were munching C rations.

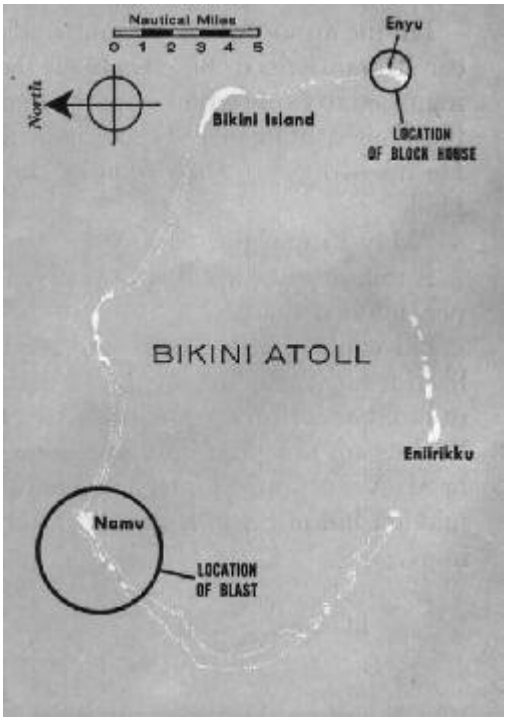
A little over an hour after shot time, Doctor Graves radioed that the command ship was also starting to pick up radiation. They would have to move farther away and we might lose radio contact. And about that time our generator began failing and the lights gradually went out, leaving us in darkness, and with only battery-powered radio equipment.

We kept checking the Geiger counter with our flashlights. After the first hour, it was still at ten

milliroentgen. If the wind didn't change and cause more fallout we probably were safe, because the radiation outside the blockhouse would decay with the passing of time. But we aready had had one unpredicted wind shift. Now we really didn't know what to expect.

The minutes ticked on. We could hear the command ship, but they could not pick up our signal. However, about three in the afternoon they started coming back, and once again I contacted Doctor Graves. Our radiation level had not increased and we figured the best thing do was to remain inside until late in the afternoon to let the outside radiation level fall. We worked out a plan for a rescue operation to take place at about 5 30 P.M.

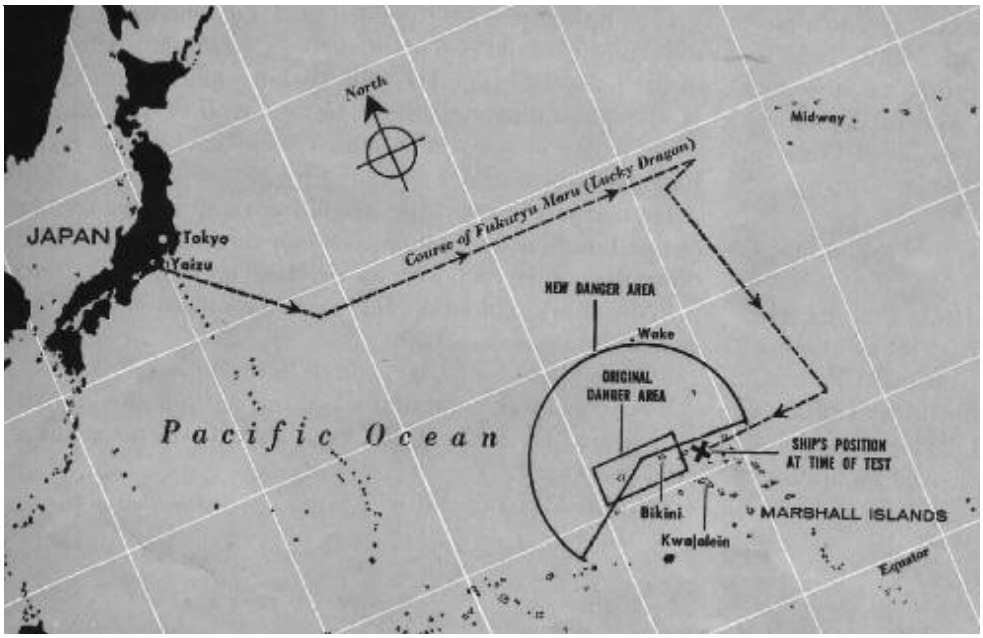
Late in the afternoon we checked the outside radiation and found it to be about twenty roentgen per hour. To keep the "hot" dust off our bodies, we wrapped ourselves completely in bed sheets, cutting holes only for our eyes. Three helicopters were sent from the command ship. As we heard them overhead we left the blockhouse, got into our jeeps and drove the half mile to the landing mat. The pilots hovered as we left the building and set down when we arrived at the mat, The whole operation took less than five minutes. As soon as we were in the helicopters we took off the sheets and a radiological safety officer checked us. Within twenty minutes we were back on ship, where we showered and were given a thorough radiation check. None of us had received any harmful amount of radiation.



Bikini Atoll: Map shows distance from blockhouse, which sheltered scientists to point of detonation.

The next day we found out how really fortunate we had been. It was estimated that fallout radiation outside our blockhouse was several hundred roentgen. Had we been forced to stay outside the entire day without protective cover, it would have been fatal to all of us.

The twenty-three Japanese fishermen in the Fortunate Dragon, which was seventy miles further away from the shot than we were, received burns. Twenty-eight Amercan personnel manning weather stations, and 236 natives on Rongelap, Rongerik and Utirik also received radiation during the unforeseen fallout.



Voyage of the ill-fated fishing vessel, Lucky Dragon. "There's something larger than the sun," shouted one horrified seaman when the bomb burst into a blaze of light about five degrees above the southwest horizon.

However disconcerting it may have been to us at the moment, our experience proved to be a windfall for the Civil Defense people. They had long hoped for something more than theoretical data on what might happen under extreme radiation conditions if people had the proper safeguards. Now, for the first time, humans had been in an area of lethal radiation and had been unharmed because of adequate protective covering. Civil Defense had representatives at the test site during the operation and by making a study of our experience they were able more reliably to predict how Americans might protect themselves during a radiation disaster. It has now been figured, according to Civil Defense, that shelter in an old-fashioned cyclone cellar with a covering of earth three feet thick would reduce the radiation level to about 1/5000 of that outside.

When we finished measuring thc yield of the bomb, it was found to have been almost twice that which had been predicted, a margin of error not incompatible with a totally new weapon and certainly welcome to the scientists. It had been so powerful that at one of the concrete bunkers one and a half miles from ground zero a twenty-ton door had been blown right through the building against the back wall fifteen feet away. And on our control island twenty miles away all the wooden buildings had been completely demolished.

Two days later when we returned to our control island, the radiation level was still much too high for personnel to remain any length of time. Bulldozers were brought in to scrape off the top soil containing most of the radiation and push it into the ocean. This reduced the radiation level around the blockhouse enough so that we could use it again for part of the test work. But for the remainder of the tests on that atoll we made a change in plans--the firing operations were conducted from the command ship. Being guinea pigs once was more than enough for us.

The End.

About the author:

Dr. John C. Clark is a scientist who has specialized in weapons of war since he directed research in "detonation phenomena" at Aberdeen Proving Grounds in World War II. In the past ten years he has often been Firing Party Commander and Test Director for nuclear tests in Nevada and the Pacific. On two occasions when malfunctions in recording devices stopped tests at the last moment, Doctor Clark personally disarmed the bombs. He left the Los Alamos Scientific Laboratory staff last March to join the Astronautics Division of General Dynamics Corporation's Convair Plant in San Diego.

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