

"The Ash Warriors: The Mt. Pinatubo Volcano's Eruptions"

by Dr. Clarence Anderegg, Air Force Historian

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Moderator: Thank you for being here, and welcome on behalf of the AFA. Dr. Anderegg is Director of History and Museums for the Air Force and was a combat pilot in Vietnam, and we're very pleased to have you here today, Sir. Dr. Anderegg. [Applause].

Dr. Anderegg: Well good afternoon, everyone. I think you're all seated in a place where you'll actually be able to see the photos up here. I'm going to talk to you today about what I consider to be one of the more amazing stories in Air Force history. It's not a well-known story because it happened on the other side of the world, but it has some really important things about it. First off, to honor the people who actually participated in this and who did absolutely a fantastic job, a magnificent job. And secondly, there are some lessons to be drawn from a disaster response of this magnitude.

This event, the Mount Pinatubo eruptions, occurred in June of 1991 so it's a little over 16 years ago. Clark Air Base, at the time, was the largest U.S. military installation outside of the continental United States. About 9,000 active duty military and civilians were in the wing at Clark along with about another 6,000 dependents, so a base population of about 15,000 people.

During the events that I am going to talk to you about, many of these, almost all of these people lived on base. The population of the base; in fact, active duty military had drawn down over the previous two or three years from a high of around 12,000 down to 9,000. Units had been closed, not because the units weren't needed; there were, whatever, but because of the NPA terrorist threat off base there was a large effort to move everyone on base and that effort was ongoing. And, in fact, when the events and the eruptions and all this unfolded in June of 1991, there were only about 250 families that still lived off base.

So for those of you who have been to Clark and have been to -- sorry, I'm having a senior moment -- the big housing complex areas that were off base, those were virtually deserted by this time; almost everyone had moved on base. To accommodate this, new dormitories had been built plus an additional 1,000 military family housing units had been built on base, so there were over 3,000 military family housing units on Clark. That's what Clark looked like in June of 1991.

That's a personal photo; that's the street I lived on, Stevens Avenue, that came right off of the parade field up at the top of the parade field, and I'll orient you to the base a little

bit more but there's a couple of things that I want to point out from this picture. The first are these beautiful acacia trees that were everywhere on base. These huge broad-spreading, sometimes a hundred- to a hundred-and-fifty-foot spread of these large trees. And the other thing I'm going to point out to you, and it may seem like a small thing but it's going to come to play in great detail a little bit later on, is notice the curbing on the streets and the fact that everything was -- kind of looked like almost hometown USA there at Clark. A beautiful place, and you can see everything manicured, and it was very much of a nice place.

Well we woke up on the morning of April 2nd, just a day late to be an April Fools' joke -- April 2nd, 1991, to see this. And this is taken from the parade field at Clark, and that's the 13th Air Force Headquarters down there at the end that some of you may recognize, and the towers, all that, and these hills back here are the Zambales Mountains which is an area behind, a large mountainous area between Clark and the South China Sea on the other side.

And coming from the Zambales Mountains and particularly Mount Pinatubo -- and that is not Mount Pinatubo; that mountain is about two-and-a-half miles away; Mount Pinatubo is actually 8.5 miles from the back walls of the Clark Air Base -- is the steam coming up.

And we all noticed it and we assumed, at that point, that it was geothermic activity because those of us on the staff were aware of the fact that the Filipinos had been trying to capture geothermal energy in that area and that they had been drilling geo wells that had failed. They hadn't been successful at it, and I think most of us just kind of assumed that's what it was until a day or two later when we found out that, no, in fact that was, well, that's what it was, it was geothermal activity. It was steam coming up from a volcano named Mount Pinatubo.

We knew what Mount Pinatubo was because that is where the old general survival school used to be, where people used to go for the old general survival school; plus it was a good initial point for attacks into Crow Valley Range, which is just to the north of this area.

But our reaction universally on the staff when it was briefed that morning at the staff meeting was, volcano? What volcano? Now some of you may have been to Clark before and you recall that to the east ten miles was the Mount Arayat volcano, the big cone sitting up out in the middle of the rice paddies. That volcano is not part of this story. That volcano is many, many, many hundreds of thousands of years old and hadn't erupted for quite some time.

I'll give you a little orientation; this is another photo of the back -- That is actually Mount Pinatubo right there, and you can see how these vents have opened up and, in fact, there was a fissure through here that was allowing that steam to come up. And I just want you to note the rugged peak here of Mount Pinatubo because you're going to see that in an after-view, probably the very last photo that I have in this briefing.

We immediately, or pretty quickly, through the American Embassy, requested a U.S. Geological Survey Team be sent to us. Well, lo and behold, the U.S. Geological Survey in those days, and still today, has what they call a quick-response team or a rapid-reaction team, and they bundled up all their equipment and they arrived to us about three weeks later, somewhat right before the end of April, and there were four volcanologists, and that really is a word, by the way.

Volcanology is the science, the study of volcanoes, and those who do that job are called volcanologists. They arrived to start giving us an idea of what we were dealing with.

Just to orient you to what we're talking about here is Clark Air Base in central Luzon, and the Mount Pinatubo volcano is eight-and-a-half miles from that back wall of Clark. San Miguel, which is the old disused Navy base, comes to play later on in the evacuation and, of course, the naval base is down at Subic Bay. Manila is over here. One more point to note is ten miles due to the east, right at the flanks, right on the uprise of the Mount Aryat volcano, was a place called the Pampanga Agricultural College, which we just shortened to calling the college, and this ended up playing a little bit later in the story as well.

A blow-up of Clark Air Base itself, bounded on the north by the Sukobi River, whose headwaters were up at Mount Pinatubo; on the south by the Abakan River, whose headwaters were in the same area. The base, kind of, with my bad art hand, blown up, but up on the point up here on the northern and on the west was what many people called Hill housing or Mac 10 housing. The parade field down here with 13th Air Force on the end, and then out here are the runways. And on the very, very far eastern edge of Clark Air Base, and this is the town of [Daou] out here, was a disused building that had been a communications center during the Vietnam days, and that came very much into play later on. From the volcano to the far western edge of here is about eight-and-a-half miles. So you can see Clark was quite a large base. In fact, it's a marathon around the base; it's 26 miles around the perimeter of Clark Air Base.

This is the Chief of the U.S. Geological Survey Team. Dr. Chris Newhall, one of the guys that showed up. You can see they're on the far side of Pinatubo. They're measuring, and what they're measuring for here is a variety of things. The first thing they asked us to do was to use our helicopters. We had

three UH-1s at Clark that were for DV support or command support. We used those to fly them up and put a ring of seismic sensors around the volcano.

There were six or eight of these sensors, one of which was actually on Clark Air Base. They are nothing more than a thermos bottle, coffee-size, silver thing like this that had an attachment. They'd dig a hole down to the rock by hand, pour concrete in there, put a bolt up, set this thing so that it could sense tremors from the earthquakes being done by the volcano, and I'll talk a little bit more about that in Volcanology 101 here in a few minutes.

But that's what Chris is doing up there; he's measuring. Notice his casual style, notice his beard. We ultimately came to call these scientists "the beards". They became a part of our team. We got to be very, very close with these guys while we were there.

I keep saying "I" because, I'm sorry, I forgot to mention the fact that I was the Vice Wing Commander at Clark when this all happened. So when I say "I," it's because I was the head of the Crisis Action Team, which is the heinous duty that always falls to vice commanders everywhere. And so I got to know these guys very well, and they got to know me pretty well also.

The results of these sensors that were set around the volcano came back to seismographs. Here is one right here. We called them the drums. You can see some run-outs of the ones up here. This is Andy Lockhart, who, if you watch shows on TV about volcanoes, Andy is usually one of the scientists that's on there speaking about volcanoes. We had absolutely the first team that was there with us. The guys that were there were the ones that were the absolute experts in their field.

Actually, I'm out of chronology here. This photo was taken right at the height of the eruptions, and you can see that Andy looks like he could use a nap about that point. He is probably like the rest of us, at this point he has probably been up for about 72 hours, so he might look a little haggard there.

Every time an earthquake is sensed by one of the sensors, it comes back to the drum that's associated with it. I can tell you right now that this was taken during the big eruptions, because those are what are called wall-to-wall readings. In other words, they're usually just little squiggles and a bump and a squiggle and a bump; this is wall-to-wall.

So just a very little bit about Volcanology 101. We had had a very severe earthquake at Clark just almost exactly a year before this happened. In fact, it was in July of '90. That was a result of some tectonic plate shift, and it was really the precursor of what's about to happen here.

A magma field is contained by the overarching earth structure above it and the crust, and it's contained, of course, at varying degrees. Sometimes it's very strong. Sometimes it's weaker. Whatever. Something that causes a fracture in that crust then allows the magma to expand, and what it really allows to do is, once it expands, you remember the old thing about Boyle's Law, right? The pressure on the surface is directly proportional to the gas that can be absorbed. In this case sulfur gas that can be absorbed within the liquid. So when the pressure comes off, like opening a pop bottle, that gas comes out of solution and it starts to expand. And as it expands, it provides, pushes more pressure. More pressure produces then further fracturing. More fracturing takes pressure off, which allows more out of solution. Now you have an increase in the pressure. This fracturing of the substrata is what causes the earthquake.

And when I say an earthquake, it's not an earthquake that can be felt on the surface, but these seismographs are very sensitive and because of where they were placed and the computer equipment that the beards had with them, they were able to geospatially locate not only in distance and azimuth, but also in elevation, so they could actually spot the exact place where that earthquake would take place. And then they had a computer-generated visual of that, and as this fracture/expand, fracture/expand, fracture/expand process took place you could see the magma actually moving up a chimney towards the surface.

So now it becomes a matter of predicting what's going to happen and it's very difficult to predict, because, without going down two or three thousand or four or five thousand feet, and that's impossible to drill that deep -- at least in that area -- it's impossible to know when this just might hit a large blockage of very strong crust that's just going to hold it and everything's going to end.

So everything we talked about was in probabilities of 50 per cent. There was a 50 percent probability that the volcano could erupt in a year. There was a 50 percent probability that the volcano could erupt in a month. There was a 50 percent possibility that the volcano could erupt in a week or in 24 hours. And they set up a warning system for us.

They were there not only to advise us, but they were also there to advise the local Philippine governments in the area. The Angeles City in [Daou] and [Mobbalocket] governments, but also the county, the province, the Pamponga government as well as the national government.

So they set up a warning series, and I'm not going to go into that now, but they did set up a system of escalation of the danger of the volcano.

While they were there, they were also able to tell us that this volcano, its type, was called a plinian volcano, named after Pliny the Younger, who wrote the story about his father, Pliny the Elder, who got toasted at Pompeii. Hence the name for an explosive volcano. This was not a volcano like the lava-producing volcanoes of Hawaii. The reason the magma gets all the way to the surface in Hawaii is because the structure that formed those islands in the first place is now a very soft, hardly-resistant overarching strata, so when the magma starts to move it makes it all the way to the surface and then dribbles over the edge and majestically flows down the flanks and you sip a Mai Tai and wonder whether or not the volcano is going to cross your highway or get to your road or whatever over a period of years.

This volcano is an explosive volcano identically in type to the Mt. St. Helens volcano. That got our attention, as well as, they were able to determine, if I were to go back to the map, that Clark Air Base -- this volcano had last erupted six hundred years ago, and twelve hundred years before that was the eruption before that. And Clark Air Base and, in fact, the Abakan and Sukobi Rivers were the result of those eruptions, and Clark Air Base was built on the pyroclastic flow of the volcano from the previous eruption six hundred years ago.

This is because one of the USGS guys was a geologist, and he was a rock hound, and he had his equipment, and he went all over the river beds and he took, all over the base, some soil samples that he analyzed, some of which he sent back to Washington to be analyzed.

Pyroclastic flow is a peculiar occurrence of these kinds of volcanoes, and pyroclastic flow is, in fact, what inundated Pompeii. Pyroclastic flow is the ejected ash superheated into the air to the point where it's so heavy that it cannot sustain its own weight and it collapses in huge clouds that run down the flanks of the mountains at 600 degrees Centigrade and upwards of a hundred miles an hour and just wipe out everything in their path. And in fact, while we were there, about a month before Mt. Pinatubo erupted, several people were killed in Japan in the eruption of Mt. Unzen; very much like that, where they were overcome by these pyroclastic flows.

Now if you want to be in on the in-crowd, you can call them PFs; so we were in the in-crowd, we called them PFs. But the actual Clark Air Base was sitting on the pyroclastic flow of previous eruptions.

Okay, so that's Volcanology 101.

The situation got to the point where the probability of an eruption was -- at every turn the volcano took the wrong turn. At every point where they said, okay, this is a critical point;

if it does this, it's going to go away, if it does this, we're still in trouble. And it always took the turn for the worse, every single time.

So they were able to determine, they were pretty sure that the eruption was going to be imminent. We had been making plans to evacuate the base for many weeks at that point. And we had been through several alternatives, and I won't go through each of those, but the final choice was to evacuate everybody at Clark to Subic Bay, which was 30 miles away. Knowing that they would be well clear of any PFs at that point and that they should be well safe there. And so if we thought it would erupt then, we would do an evacuation to Subic Bay.

We further stockpiled, but we knew we would also keep a small security force at Clark because we had a large munitions storage area. We also had shoulder-held Stinger missiles and CX explosive, and stuff like that was stored there that we didn't want to leave unguarded unless we absolutely had to.

So the plan was to evacuate all non-essential military people or all but the essential military people, i.e., the security police group, which was the largest group, security police group in the Air Force at the time; it was 960 people. We would keep all the cops and a small contingent of people to maintain them; a small medical group, a few cooks and bottle washers, the staff, the crisis action team staff, the 13th Air Force commander who was co-located with us there at Clark, the wing commander, and some other folks, numbering about a little over a thousand, about a thousand and fifty as I recall the number.

Our biggest fear was that we would have to evacuate the base during the week when the kids were in school and people were at work on the flight line, and that we would have cars going this way and this way and this way and everything else. Well we did catch a break in the fact that the USGS guys encouraged us to evacuate the base on the evening of June 9th. So this is a mere two months after the first steam started coming out of the mountain, which meant this progressed very, very rapidly in geological terms, which was also good for us because we were able to hold people's attention with it.

At any rate, they said we really think you should evacuate; we recommend evacuating the base; we think the probability that the volcano will erupt within 24 hours is about 50/50. And, of course, what we were afraid of was another Mt. St. Helens that, in fact, these pyroclastic flows would consume the base again.

So General Willie Studer, who was the 13th Air Force Commander, at about 10 o'clock at night on the 9th made the decision to evacuate the base. Now from a historical standpoint, I want to tell you that no commander ever, in any wartime

situation, has had to make a more difficult decision than that.

And the reason is, is because many thousands of people were involved; many thousands of lives were involved. Yet, if it was the wrong decision, then what do you do two weeks later? Do we bring them all back to the base? Do we then try to convince them that it's safe to come back? And then, once we have them back there again and we say now we to evacuate again, which could happen, it could stop and then start again, then do we say okay, time to grab your bags and evacuate again? You can only cry, say the sky is falling so many times before your credibility is gone.

And the other reason this decision was difficult, and this is true of disaster responses that I've studied and I'm sure many of you are aware of, is the concern about the disaster is directly proportional to the distance from the disaster. So the people at the embassy in Manila were slightly less concerned than we were. The people at PACAF Headquarters were even less concerned than we were. And the people in Washington had no concern. [Laughter]. So it was a difficult sell, if I can use that word, to try to make sure.

One of the clever things that we did -- I didn't; General Studer did -- was that the guy that was originally up there with the string measuring, Chris Newhall, had been there two months and he had to return; he was replaced by an equally good guy. But on his way back to the states, Chris Newhall personally stopped and briefed everybody all the way along the road. And when he looked them in the eye and told them exactly what was happening, then they became believers and that made a very big difference. It was the human touch and the human approach that the message traffic couldn't convey. All right?

Okay so, he made the decision to evacuate. We started evacuating the base at 6:00 a.m. on the morning of June 10th, and we totally evacuated Clark Air Base in less than six hours. The base was gone; the people off the base were gone in six hours. It was a very successful evacuation. This was part of the plan. Cars; everyone evacuated in their POV. They came to the flight line where they were staged and then released and headed to Subic Bay. It was done in phases. I won't tell you how we did it. The obvious way to do it was to start at the near part of the base and work your way back, which is what we did.

And they were told -- there were many, many instructions, including an evacuation pamphlet that was hand delivered the night before the evacuation. That night, as soon as General Studer made the decision, it was hand delivered with all the information in it, which had been on TV and radio for many, many days before that and had been covered in commanders' calls and first sergeants' calls in many, many ways.

But one last reinforcement, it was hand delivered to every

home, all through the family housing units as well as every dormitory room. I make a point of that because there is no such thing, we'll talk just very briefly at the end about it, there is no such thing as telling people too often what it is they need to do. There was still a considerable percentage above the joking 10 percent who didn't get the word, and this caused a lot of problems later on.

Okay, so that's the evacuation ongoing there. I'm going to show you an example. This is an evacuation in the face of a deadly volcano that could erupt at any moment. Does anyone notice anything unusual in this photo? Those are jet skis that are going on the evacuation to Subic Bay. You see in the front the cardboard boxes; that's water [priority] supplies that people were given in case they didn't have the right amount with them. They could take whatever they wanted in their cars, and this guy took his jet skis with him, but it was an orderly thing and it went very quickly.

We couldn't have asked for a better response. I doubt that we would have been able to do the kind of response, and I'm going to pick on the civilian _____ team that _____ delay 15,000. I doubt that it would be able to successfully in a civilian population be able to orchestrate an evacuation like this. But because it was military and there had been a lot of talk about it and a lot of talking of how we're going to do about it, it came off pretty well.

Okay, so they got down to Subic Bay, which is made to house about 3,000 people; 15,000 people arrived. [Knocking]. Hi, what's for breakfast? So the Navy took over the bed-down of these folks at Subic Bay, and they put them in the dorms, and the gyms, and the hallways, and the schools. Every military family on that base that had a house brought in a family or, in some cases, two families to live with them, got them all bedded down. There were some problems with that, but I'm not going to go into that right now.

More supplies that were available on the flight line.

There was humor involved, albeit a little bit of gallows humor. This is a sign that was in front of the Clark Air Base Officers Club that on June 14th would be the Last Days of Pompeii Party. The evacuation was on the 10th, so that party was canceled; it didn't happen.

Oh one last thing that I wanted to say about the evacuation was that pets were taken on the evacuation. Everyone was told to take enough medical supplies and medicines and things like that to last them three days, because we weren't sure how well the BX and the commissary, the naval exchange at Clark [sic] could accommodate things like diapers and all other stuff that goes with moving a family with children. But pets were taken as well,

and were encouraged to be taken rather than leaving them in the houses. Pets will come to play later on.

June 12th, two days later, 48 hours later was the first eruption of the volcano, and this is just a marvelous photo of it. We happened [inaudible] then, all of our security police forces out guarding the entire base, so the ones that were on the western parts of the base that were nearest to the volcano, the plan was to blow the siren and everyone would evacuate over to -- remember I showed you where that [Daou] command post was, out at the western thing, where we were 99.9 percent certain we'd be pretty safe because none of the PFs had actually ever gone that far before. [Voice].

It was interesting to stand on the flight line and watch cars whiz by. I didn't make the point there were no aircraft at Clark at this point except for the helicopters. The 374th wing, which some of you are familiar with, the C-130 wing had moved up to Japan two years earlier, and as part of an [inaudible] program down all of the F-4s were flown out of Clark [inaudible] just a week before the eruptions. That was all part of what was going to happen anyhow. In fact, Clark's wing was going to actually be shrunk to a group to continue to maintain Cope Thunder, but there was not going to be any more flying operation at Clark.

On a side note, I got to fly the last F-4 out of Clark back to the bone yard, PACAF's last F-4 after 24 years of having them there.

But it was interesting to stand on the flight line and watch cars whiz by us with people taking pictures over their shoulder as they raced off, and vehicles raced off the base. The chronologists said this is just a throat ring. [Throat clearing]. Excuse me, that's what I have to do as well. Because this is vertical. When the big one comes, it's going to be lateral. Okay?

We have another. This is actually taken almost at the same time from a different part of the base, so you can get the perspective of how close to the base this was all happening, and this was taken from the Daou area, so this is twelve and a half miles away. So the base goes another four miles closer than this. You can notice how fast this thing is rising. The eruption sequence started at 9 a.m. on June 12th, and we had another one that night at 9 o'clock and another one the next morning at 9 o'clock, then the next evening at 9 o'clock, and after two days of that we're saying ah, Old Faithful, every 12 hours. And for the first three days, it did; just about every 12 hours give or take 15 or 20 minutes, we would have an eruption like this.

We got nothing on the base from this because, at that point, the skies are clear, as you can see, and the ash went up and the

prevailing winds took all the ash out over the South China Sea someplace, and it didn't really bother us at all. In fact, we kind of got used to it after seeing a few of these. But I'll tell you, the first one was a real throat clencher to see.

There's a really spectacular one here. These would go up to about eighty to ninety thousand feet in about four minutes, which time to climb, that's pretty darn good. I mean, it was really spectacular watching these things go off.

We started to learn about the volcano. This is one of these things that you learn as you go and you hope that you can win before you've stopped learning. [Laughter]. We found out that when the volcano erupted, that the barometric pressure on base would drop significantly, as measured by the weather. We also found that our weather radar on base could track this and we could actually measure the tops and we could tell which way it was moving. It was very important to the volcanologists to observe the thing in motion. We were able to document as well as watch it.

[Inaudible] June 15th. This one, Martha. [Laughter]. This, you can see is vertical. It is somewhat vertical, but you can see it is taken from the far side of the base. It's the old Cope Thunder ramp, for those of you who recognize it, and that's just a derelict F-105 that's sitting there. It looked like somebody just dropped three or four nukes in a string right across the Zambales Mountains.

This eruption was the first of six that day that came one after another. I'm going to point out to you the fact that -- notice that the sky is different. See here, the overcast on the clouds; that's because six hours from us is Typhoon [Yunia] that is coming at the same time. A hundred and 145 mile-an-hour winds. Huge storm. Tremendous rain. We were pretty sure that if we got an inch of ash fall that was wet it would knock down some buildings. Well throughout that day we actually got nine inches of ash fall and we got about nine inches of rain within a four-hour period at the same time.

This is what it looked like at two o'clock in the afternoon. Totally dark. Raining mud or mudding rain, whichever way you wanted to look at it, between the typhoon. The super-typhoon hit the ash cloud from these eruptions that were occurring, and it never came out the other side. There is no photography, and I tried to find some to bring for you today but I couldn't. There was no photography that showed the typhoon. The ash plume -- whack -- stopped it. The volume of ash that was in the air was such that it actually stopped the rotation of the typhoon.

This was the second largest volcanic eruption of the 20th Century. The eruptions through that day ejected more ash into the atmosphere, ten times the amount of Mt. St. Helens. And the

reason it did was because the magma field that caused the Mt. St. Helens eruption was one cubic kilometer. In fact, I just heard that on TV again, just the other day on a show on volcanoes. The magma field under Mt. Pinatubo, the cause of the Mt. Pinatubo eruptions was three cubic kilometers. And that's geometric in proportion, not arithmetic, so it's actually nine times bigger.

The bad news is that this picture wasn't taken at Clark. This picture was taken at Subic Bay. Because of the rotation of the typhoon and the ash in the air and the rain from the typhoon, Subic Bay got clobbered every bit as bad as Clark did. So those 15,000 people that we sent to be safe ended up with no electricity, no food, and no water, and we'll talk about them here in just a minute.

This is what Clark looked like two days later. This picture was actually taken on the 17th of June, two days after the major eruptions. We called it nuclear winter. This is what the whole base looked like. And notice that there aren't any curbs. And the reason there aren't, of course, is because of the ash fall. And this becomes very important in just a couple of minutes.

That's one of the new housing areas at Clark. It was very disorienting. It was very, very difficult to find your way around the base because there were no streets and everything looked white. It all looked the same.

This is the back of my house. Notice the depth of the ash here where it's eroded away. And notice that all the acacia tree branches now, not all of them, but a tremendous amount of them are actually on the ground. This caused us huge problems.

Here's a close-up of one of our security policemen getting ready to put the flag up at 13th Air Force, having to fight his way through the branches and stuff to get that done.

This is one of the supply [inaudible]. There were 110 buildings collapsed on the base. Notice this one is still standing. That's because that was built [inaudible], it's made of wood. These were made over the previous ten years, and they were made of steel. This one was able to [inaudible]. I mentioned that while we were having all that ash and mud we were also having constant, every-two-or-three-minute earthquakes of a magnitude of around 5.5-6.0 on the Richter scale, constantly, just one right after another.

By this time, at three o'clock in the afternoon, we had evacuated everybody back to the college. We had totally abandoned the base at that point, and we came back the next morning when things calmed down.

This is the power plant. You can see it's collapsed. Part of the, some of the generators, this [inaudible] Clark. These

are the radiators that cooled the generators on the inside. Notice that they lay flat [inaudible].

This is a new parking lot by the water [inaudible] bay. I'm going to talk a minute about that right now. The base was covered with ash. All the [inaudible] was filled; therefore, as typhoon [Yunia] [inaudible]. [Inaudible] after that and a whole new geology started on the base. The water went where it wanted to. So we had constant floods on the base, and you can see these new channels being scoured out by the water.

So it changed, and totally changed, the topography from [inaudible] to Mt. Pinatubo out to about 20 miles east of the base over the next ten years. And in fact, many more deaths cause in the Philippines over the next ten years than actually occurred during the days of the eruptions, because of a thing called lehar.

All of the valleys up around the volcano were filled with ash. I mean filled. Six-hundred-foot-deep valleys. You saw those deep valleys around Mt. Pinatubo. They were just level. It looked like the moon up there. And as the rain came, it eroded away, and as these erosions got deeper, then you had these huge cliffs of ash that still inside, five- or six-hundred degrees Centigrade.

And you watch the sand come up and wash your sand castle away at the beach, and it gets wet and it gets wet and then the side slides down into the water. It's the same of thing with the ash. And now this ash, this hot ash, tremendous weight -- mass -- of this ash in the water, comes racing down to go wherever it wants to go. Called a lehar, and that is the killer of volcanoes the day after the eruptions are over, especially in the mountainous areas of South America.

But this is just a little view of the erosion on our base. Of course, cleaning off the roof was a big deal.

Okay, electricity. I'm going to tell you a quick story and then we're going to real quick finish up, so I can have time for questions at the end.

I showed you the generators. While we were planning our crisis actions before the eruption started, I had a meeting with my CAT one day and a senior master sergeant from the fire department came to me and he said, Sir, he says, I've got an idea, he said. Water's going to be a problem. Why don't we take our pumper trucks and tanker trucks in the fire department, fill them with potable water, and put chlorine it, and so [inaudible] for when we come back. And I said great idea, Sarge, go handle that. And I forgot all about it. That water [inaudible] because when we came back, we had no water on the base. And the reason we didn't [inaudible]. We had in our plan to turn off the valves

at the bottoms of the [inaudible]. We did that, and when we came back, the morning after the evacuation, the guys went up from CE and they turned the valves back on and within a few hours all of our water was gone, because underground, all of the earthquakes had totally destroyed the water [inaudible], let all of our water go away from us. So all the water we had were in those fire trucks. And believe me, there was no way to get anymore to us, and I'll show you why about that photo that's going to come up in a minute when you see what happened to the bridges.

So we had to have electricity to power the wells to get the water out of the ground. And you saw the power plant. Well this young machinist is a staff sergeant [inaudible] go to his machine shop and get a hand-powered generator going to turn a lathe, and he turned a piece of metal into a fixture that would allow us to hook one of those radiators on that power plant up to a fire truck with water to cool the generator to get electricity to the well, so you had to cool the electricity to go -- you see the idea?

The only problem was that we couldn't find the wells. And the reason we couldn't find the wells, because there were no curbs. Because all the wells were marked at the corner of Broadway and Vine, fifteen feet in and ten feet over is where the cap is that comes up that you go down to get to the well motor. We couldn't find those. We couldn't find the corners. We couldn't find the damn wells, because everything was buried under ash.

It took us about nine days before we got water flowing back on the base again, and then in very limited [inaudible] but at least [inaudible]. The volcano continued to erupt throughout this albeit not [inaudible] continued to erupt. And every time it would erupt [inaudible] ash [inaudible] would arc and it would short out the electrical grid so we [inaudible], and that's what this fire truck [inaudible]. [Inaudible] and sort out [inaudible].

This is a [inaudible] new stream that's just [inaudible]. [inaudible] new spouts, new [inaudible]. [Inaudible] the water [inaudible].

Okay, where did they [inaudible]? Well, [inaudible] on the map. It's about 300 yards [inaudible]. You can see the abutment [inaudible].

Security. Our security was better [inaudible]. I'll never say anything ever again in my life about somebody bad, about somebody with a beard.

Okay? You recognize that. That's [Angeles] City right there on the other side, and that's the main gate at Clark, looking over the edge. Okay? And you can see what these lehars

have done as they've come down the river; they've just scoured an entirely new riverbed and taken out the bridge. You can see the abutment here on the other side. Standing on the abutment here, there's a cable that used to be part of the bridge right there.

Security. Our security was better after the evacuation than it had ever been before. People ask me all the time, well what about theft and looting and robbery. Well there wasn't any after the evacuation, to speak of. And that's because all 906 security policemen were on duty every day, seven days a week, twelve-hour shifts. Nobody had dental appointments. Nobody had to go to Parent Teacher's Association meetings. Nobody had to go do this. Nobody had to go do small arms training. They were all on duty twelve hours a day, seven days a week.

The other reason was we also got permission, at that point, to let the dog handlers let the dog off the leash. That made a big difference.

And the other thing that made a big difference was the Philippine Air Force Security Police guys actually shot a looter coming over the wall; shot and killed a looter coming over the wall. That word got out very quickly. So we really didn't have trouble.

This is our Security Police at morning formation. I wanted just to point out to you; this is certainly not military attire. This is a bandana wrapped around this guy's head. You can see his Rommel glasses here on his forehead. We all had what we called "cement head" because we were living in this ash constantly, and when you drove a car it just went everywhere. You couldn't drive more than ten miles an hour anyplace, because of the ash swirling up around you. So it was in your nose, it was in your eyes. Those of you who have been to the desert, I'm sure, know that kind of an experience.

Okay, the evacuation. Two days after Subic Bay started having its buildings fall down -- you saw the photo from there; they got it as bad as we did -- all of their electricity was out; therefore, their water was out; therefore, their sewage was out. Under a task force called Fiery Vigil, we evacuated 20,000 people from Subic Bay over about a four-hour period.

The Abraham Lincoln, the newest of the Navy's carriers was on its way to the Gulf, going through the Pacific. That task force was diverted to Subic Bay, and we started loading people on. They could take what they could carry. So everything is -- what that woman right there has in her hands, that's what she evacuated back to the United States with.

I will point out to you also that about 80 percent of the airmen on base who were married were married to Asian wives, and about 50 percent of those were married to Filipino wives, many of

whom had never been to the United States. And so they were evacuating, sometimes with their spouse but usually not.

I'll just make a point right now. I was going to save it to the end to say that we made a big mistake in this thing in that we initially started to evacuate out of Subic Bay all of the dependents, thinking that we would then bring the military people back to Clark for a recovery operation. Well once we knew that we had no water and we had no electricity and we were barely able to keep going with what we had with a thousand, there was no way we were bringing back five thousand. So then we evacuated the military. So what that meant was that in front of the evacuation stream were the dependents, the wives and the children. In the back of the evacuation team were their spouses with no way to communicate. Chocolate mess comes to mind. It was a mess.

Okay, pets. This is a hangar deck on the Abraham Lincoln. The dogs are on the hangar deck. The cats are in whatever, in their cages. The dogs leashes are tied to the tie-down straps, and they're only long enough to get halfway to the tie-down place next to them, which, for those who where there, was a pretty amusing situation because the dogs tried to chase each other in circles.

The task force took them down to Cebu, which was an island further down in the archipelago that allowed them -- there was an old Vietnam era airfield there. They were then taken by helicopter off the ships to the airfield where they were then policed up and put onto contract charter flights and flown to Guam. This is at Guam where they were staged from Guam on out to Hickam and from Hickam to Travis, Norton and McCord, where they were given a one-way airline ticket to any place in the 48 continental United States they wanted to go to. I can answer more about that later.

This is the pets stacked up, because Guam has quarantine laws so all the pets were confined to the football field at Guam under tents, and you were allowed to visit them, but they had to stay in quarantine.

I think this picture says it all. Right here. It's one of my favorite pictures from the evacuation. That was taken at Norton, I believe. And this one says it too. As does this one.

Pregnancies. If you have a young population of 9,000 people, how many wives are pregnant? I used to know that number. I don't remember it right now, but that's a lot. The ones that were in their third trimester were evacuated early from Clark to Kadina, where there is a hospital there. And they were kept there until they delivered or they could be safely moved on back to the States. However, despite that, there were still six births on the ships going from Clark down to Cebu. So there is a Abraham Lincoln Lopez out there someplace. [Laughter]. I think

it was the name that was given to him.

We moved all the household goods. This was a huge undertaking logistically. We packed up all the household goods in 3,000 homes and all those dormitory rooms, and sent them all back to the States. I don't usually do math in public, but I'll tell you that typical household goods load out as about 10,000 pounds. That's the average. Those overseas containers, the plywood they put our household goods in, those hold 1,000 pounds each, so that's ten containers times eight sheets of plywood times a hundred houses a day times three thousand houses. We moved everybody out in about 45 days, and that's about a quarter of a million sheets of plywood just to build the crates. The logistics effort was incredible.

Most people got back everything from their houses. None of the houses collapsed. The only damage in the houses was occasionally one of these mini-lehars would hit the front door, blow through the house, and go right out the back door. And then there would be a lot of water damage and stuff to the furniture inside, but most people got back what they --

We prioritized. The lowest houses we moved first. This is an area that we packed out immediately because, by the way, July starts the rainy season in Clark, so we knew we were going to have tremendous rain and we couldn't predict where it was going to go.

You can see that we moved this area, the housing area, just about in enough time. This picture was taken about a week after that was. And notice that there is still ash in the sky, because the volcano continues to erupt although the earthquakes were down to three or four a day by that point.

Remember Mt. Pinatubo at the beginning of my presentation. That's it today. Actually, that photo was taken seven years later, in 1998. This caldera -- now you know the in-term -- this lake is fifteen-hundred feet deep and 1.2 miles across, and this used to be Mt. Pinatubo above it here, like this.

Okay, I'm sorry I went right up, but I do personally have time for questions, and I'd be glad to take your questions if you have some, if you'd like to ask. Yes, in the back.

Voice: [Inaudible]. Is there any permanent change in weather patterns due to the earthquakes?

Dr. Anderegg: Yeah, that's a good question. He asked, if you couldn't hear him, if there were changes in the weather pattern. There definitely were changes. The ash suspended in the -- and this is from a national oceanographic, a NOAA report -- the ash in the air, suspended in the air, lowered the global temperature of the earth in the northern hemisphere by 6/10 of a

degree Centigrade over a two-year period, which is more than all of global warming had warmed it in the last one hundred years. One volcano. Yes.

Voice: [Inaudible]. Have the lessons learned helped in the design [inaudible] for future military bases?

Dr. Anderegg: Well I'll tell you there were lessons learned already in work there, because what I didn't show you was pictures of Chambers Hall. Some of you that have been at Clark remember the big Chambers Hall Dormitory that was there; a visiting officers quarters. That was undamaged because it had earthquake-proof joints in it, and we were able to use that as housing for all of us who couldn't go back and live in our houses because we had no way to a) get to them because of all the damage and trees and everything and the floods, but also no electricity and things like that.

I'd like to say that we've learned more from this than -- I would hope that we've learned more from this and other similar kinds of disaster responses that the Air Force has done, such as Katrina and other things. I do know that there were lessons learned in Katrina that came from Clark, at least there were -- sorry, my ego's too big there -- that they came from Clark, but they certainly were reinforced by Clark. And that is you have to have plans, and you have to have communication. We had communication. We always had, and I'm sorry I missed this, we always had our brick system. Because that [Daou] command post, remember over there; one of the reasons we picked it was because it had triple-redundant generators and they were filtered for nuclear biological chemical warfare, and that filtered the ash, so we were able to -- those generators ran all the time. Every place we were, we always had bricks, including all the cops that had bricks and everything for disaster response. Yes.

Voice: Those bricks, with all the ash and rain -

Dr. Anderegg: They worked fine.

Voice: They were fine?

Dr. Anderegg: Yep.

Voice: I thought the ash would get [inaudible].

Dr. Anderegg: Nope. They worked fine. I'm not sure why that happened. Maybe it was something the com guys did, but we had it all the time.

More questions? Yes. I think one more and then we'll probably finish up.

Voice: [Inaudible] you're very knowledgeable about

volcanoes. [Laughter]. And I wonder if you have studied or [inaudible] the eruptions at Vesuvius during World War II.

Dr. Anderegg: I am aware of that, yes. And how many airplanes were lost there?

Voice: Well I was there.

Dr. Anderegg: Oh, you were. Well I want to talk to you.

Voice: I know I just want to [inaudible]. [Beep].

Dr. Anderegg: I think that's my sign that I've talked too long.

Voice: We didn't climb out. We weren't disciplined like you were. [Inaudible] got ash coming out of the airplane to go away but to stay in that airplane [inaudible] to come back --

Dr. Anderegg: Yeah.

Voice: -- less than seven hours --

Dr. Anderegg: I'm not so sure that it was because we were disciplined, but we had really good advice. I mean, the real saving grace in this whole thing, I can't say enough about the fact that we had the right people with us, and that was the USGS team, and they had the right equipment, and they were prepared to deploy. They knew how to pack their stuff and come to us.

Well thank you very much for your attention. I appreciate you coming today. Thanks a lot.

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