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Speaker 1: My Safe LA is the public education partner of the Los Angeles Fire Department. You're listening to a My Safe LA fire and life safety podcast.

Cameron: Hello everybody. This is Cameron Barrett, the education director for My Safe LA, and you are listening to another My Safe LA Fire and Life safety podcast. And I'm joined today by a friend of mine, the director of communications, education, and outreach at SCEC, which is the Southern California Earthquake Center. His name is Mark Benthien, and he's going to talk to us about earthquakes. Hey Mark.

Mark: Hi Cameron.

Cameron: We are sitting at the SCEC headquarters at the gorgeous campus of the University of Southern California, and it's just another perfect, gorgeous, glorious southern California day, and some people say we have this because we have a big price we pay for it, which is earthquakes. Do you look at it that way?

Mark: Actually I look at it a bit the other way in some sense. That we have this, not because of the price of earthquakes, because earthquakes have made southern California as it is. There's some truth to that, so if we didn't have the mountains the way they are then the storms would go through in a different way, and the weather would be modified by that.

And the way that we have the low lying basins, and you have the onshore flow, all those things are related to, kind of, the geography of southern California. The way that we have the mountains, the way that we have the deserts because of the mountains blocking the rain, all those factors really play together. And all the mountains, and hills, and the valleys that we have in southern California are all connected to earthquakes.

And the faults being on the plate boundary between the Pacific plate and the North American plate, the boundary being the master fault, the San Andreas Fault. And even because it bends, and because of the way that southern California and California has been constructed over time, the way that the fault bends has created all sorts of other faults, like cracks in a window creating smaller cracks over time.

So all of that fits together into this jigsaw puzzle of southern California that has created all the aspects that we have here. If we didn't have the varied, you know, geography, mountains, and valleys, and different places, we probably wouldn't have the film industry here where they can easily film in all these different locations. If we didn't have the Hollywood hills, we wouldn't have the Hollywood sign. All these things really fit together.

Cameron: You know, growing up outside of southern California like many people who now live in southern California did, I of course knew about the San Andreas Fault. Everybody knew about the San Andreas Fault where the Pacific plate and the North American plate come together and [strike 00:02:59] slip against each other. But what I didn't know about were all those other faults that you talked about. All that, God that shattering that happened to the west of that marriage of those two faults. And the interesting thing to me is that since I've been here, we've been in kind of an earthquake drought ... I've been here about fifteen years ... But really any of the significant earthquakes that have happened in southern California in the last oh, 30, 50 years had nothing to do with the San Andreas Fault. Did they?

Mark: Really the last 150 years, so the last real earthquake on the San Andreas was in 1857 on part of the San Andreas in the southern California area. The part that goes from the Cajon Pass north to the central California, kind of west of San Luis Obispo, so that part ruptured in 1857. It was a 7.8 magnitude earthquake, 7.9. We didn't have instruments there at the time so it's all kind of estimated by what was experienced. The part from the Cajon pass, right there at the interstate 15, from there, south through San Bernardino down towards Palm Springs and further down toward the Salton Sea, that part hasn't ruptured since 1680.

Cameron: That's a really bad thing, isn't it?

Mark: Well, the paleoseismology that's been done ... That's like paleontology, but you're looking at old earthquakes by digging a fault across, I'm sorry, digging a trench across the fault to look at the history of older earthquakes ... Shows that on average in that section there's been an earthquake every 150 years or so. But the thing about averages is that sometimes it's longer, and sometimes it's shorter, and so it doesn't mean that because it's been more than 300 years now, 334ish years [inaudible 00:05:00], that we're now twice overdue. Overdue doesn't quite describe it because maybe that's just one of the longer periods. And so, it's not that it has to, you know, it's not that it's built up twice, you know, so much.

But at some point there will be an earthquake along that part of the fault. And that's the part where the ShakeOut scenario was created. A particular earthquake on that stretch of the fault, and actually even further north into what did rupture in 1857. As a potential, one of the many types of earthquakes that could fit, fill that gap of earthquakes. And that, there could be many other types of earthquakes, but this one was looked at as the one that would cause the most damage to a broader region of southern California, you know, to look at what happens when a big earthquake like that shakes everywhere rather than like in the Northridge earthquake where the damage was significant in the valley, but fairly limited to the San Fernando Valley, I mean there were pockets elsewhere,

but in this, a big earthquake on the San Andreas is going to affect everyone kind of at the same time. You won't be able to have fire departments come from one part of southern California to another because they're going to all be dealing with their own situation.

Cameron: So you mentioned the ShakeOut scenario, and that led to a drill ultimately, didn't it?

Mark: Yes. So the USGS led by Dr. Lucy Jones back in 2007 [well, 00:06:46] developed in 2008 developed the shakeout scenario as kind of an improved, very detailed, comprehensive analysis of what would happen when an earthquake, like an earthquake on the San Andreas, were to occur in southern California. That quickly became the basis of a statewide exercise, and those of us in the Earthquake Country Alliance working with Dr. Jones and others said, you know, how do we get everybody else to participate? And what would have been an exercise involving maybe ten thousand first responders and emergency managers and others, which would be huge on its own, and it was, [inaudible 00:07:29], we say how do we get everybody else to participate, do something, do an activity for earthquake awareness? We wanted to do something that would get people talking.

The social science research said that when people talk with each other or see each other doing things, they're more likely to do those things, and particularly for preparedness. So people who talk about earthquakes and what they've done for preparedness with their colleagues or friends or family, that those people are more likely to take action. So, we wanted, what can we do that would get people talking, get people doing things that people can see? And so, we said oh, an earthquake drill. The thing that most people can do that's actually really important to practice on a regular basis is to practice drop, cover, and hold on, what you should do to protect yourself during an earthquake.

But we also always have important messages of storing a lot of water, having a fire extinguisher because in the ShakeOut scenario, we think there could be up to 1600 fires that could start that require a fire engine to respond, so how could people put out the little small fires before it becomes something that requires a response? So that's really all of us working together because, of course, the fire agencies would be so overwhelmed with everything, not just fires, but also rescuing people. So, those messages were the key from the start, and continuing to be making sure people are practicing, and doing something very simple, one minute to get under your desk to practice that.

But each year was also something we didn't expect to happen. We thought it would be a one-time thing, but it was really the interest of the participants of southern California where it originated, and even people from northern

California for wanting to join that has kept it going. And that it's now grown beyond California. The Earthquake Country Alliance in California runs the ShakeOut, and then, we've worked with similar groups, the Southern California Earthquake Center has worked with groups like in British Columbia, the British Columbia Earthquake Alliance, or in the central US, the Central US Earthquake Consortium. So, we have these different groups that we've worked with around the country and in other countries that have taken the ShakeOut model and made it their own, and be able to have it still connected to where we had 25 million people last year.

Cameron: That's amazing.

Mark: In 2013.

Cameron: Yeah. 25 million people who on a specific day at a specific time ... most ...

Mark: Most.

Cameron: On a specific day at a specific time.

Mark: On the ShakeOut day of action we're calling it now, the third Thursday of October, most participated then. Now, we have some states like Utah, they have their ShakeOut in April each year and some other days. But, but we're really taking this day. And this is also inspired, another big activity called America's Preparedathon that FEMA is coordinating with many supporters to take that same concept and apply that for people to practice what to do for other hazards. And there's a spring National Day of Action with certain hazards like tornadoes, and hurricanes, and floods, and wildfires. And a National Day of Action in September that will kind of lead into ShakeOut, where people are doing other hazards like practicing for severe storms, pandemic flu, hazardous material issues, and of course earthquakes. So, but it has the same idea of people signing up on a website to do their activity, to be something big that people talk about, and then for people to see each other doing these activities. So, again, it's really the research that's supporting all that.

Cameron: I would imagine that as an outreach director for earthquake awareness out to the public, it must be kind of difficult.

Mark: Well, it's not that we haven't had earthquakes, it's just that we've had, you know, relatively minor earthquakes. And so, it's one thing if you haven't had any earthquakes to say there could be a big earthquake. It's actually even more complicated that people have felt earthquakes, and think, oh I've felt earthquakes. They're not that big a deal. And so, they have to more carefully and strategically explain that the earthquakes that you've felt could be thousands of

times smaller overall compared to the earthquakes that can happen in the future. So what your past experience of earthquakes may be may not tell you, even if you experienced the Northridge earthquake or the Sylmar 1971 earthquake, these larger earthquakes that caused a lot of damage. Even if you were in the San Fernando Valley, near the epicenter of those earthquakes, the type of situation that may follow a San Andreas earthquake or a large earthquake under the more populated part of Los Angeles, such as like on the Quinta Hills fault or such, can be quite a different situation. And it may be because either, you may not feel a lot more shaking, if like you felt the Northridge earthquake near the epicenter, the shaking you felt then may be among the most intense shaking you'd ever feel in an earthquake in southern California, but a San Andreas earthquake may shake longer, maybe not as intense, but longer, and things may break and fall because it just keeps shaking.

Cameron: And that's because of the type of faults that you're dealing with here, right? Northridge was a thrust fault, a blind thrust?

Mark: Right. So, it kind of moved the valley up. It's not that the shaking is longer in the San Andreas because of the different type of fault. It's because it might rupture 200 miles of fault versus just 10 miles in the Northridge earthquake. And so the duration, you have waves coming-

Cameron: Yeah.

Mark: As the fault ruptures as the kind of the earthquake travels down the fault and zipping and sliding the rocks side by side. All along that, the waves are coming, so the shaking might be for like 2 minutes in that earthquake versus 20 seconds in the Northridge earthquake. So, and then the regional effects will, you know our water, our power, our gas, our transportation will be affected, you know, knocked out for a longer period of time.

So, what we've experienced in the past does not indicate what we're going to experience in the future. People who have felt the recent earthquakes we've had, the La Habra earthquake 5.1, the, you know, we could have an earthquake that's a thousand times larger over everywhere. Not, but you wouldn't feel ... A 7.1, by the way, would be a thousand times larger than a 5.1 in terms of the overall energy released. That doesn't mean you at a certain point will feel, will be shaken a thousand times more intensely or a thousand times more duration wise, but everybody spread out. It will be felt over a larger area. The shaking will be more intense, certainly at the epicenter, and also last longer.

So, all those factors combined together. And for people who weren't born at the time of the Northridge earthquake, and have grown up in southern California, or

for people who've moved into southern California, you just don't quite know what, like, what is likely to happen.

Cameron: Right. Did you, were you born and raised in southern California, Mark?

Mark: In San Diego.

Cameron: OK, so you've always lived with earthquake.

Mark: Yes. I mean, and the most significant earthquake I've really experienced was Northridge. I was at UCLA at the time. I was in San Diego like for the Whittier Narrows earthquake that was before that, and that really didn't affect San Diego. I don't know if I even remember feeling it. It could've, should've been felt down there, but I don't remember. So, though it may have been, what, one of the reasons why I chose to get into earthquakes and earthquake preparedness, because it was right at the same time that I made that decision I was looking at what do I want to do that can kind of make a difference in science in, kind of, the public in California, and the obvious thing was earthquakes. And at first I thought I had to become a scientist and predict earthquakes, so I went to UCLA to start that. Then I realized that there were a lot of people working on that, and another avenue was communicate the information more directly to people, and that's why I've gotten into the work I do.

Cameron: We can't predict them, but we kind of can. I think that might be where the public sometimes gets confused because they hear things like the statistic that we're over 90% likely to have a major earthquake in southern California in the next 30 years. So when we hear that, I think a lot of laymen might think well why can't you predict these things? You know where the faults are. Why can't you predict them? Why can't we?

Mark: Well what we do is more like forecasting. What we've gotten really good at is predicting that when the earthquake does happen, what the shaking is going to be like. So, that, from all the information we've gathered about how California is put together, what type of rocks, what type of structure of the subsurface throughout the state, and how shaking will get amplified in basins full of soft sediments that have eroded off mountains, and how that amplifies the shaking compared to the mountains.

We're able to make a lot of these kind of very sophisticated simulations of what might happen, and then use that for our understanding of the levels of shaking to be expected. And then you can design a building to withstand that improved level of information compared to what we had 20 years ago. So we're getting better at that. We're getting better at having information that we can quickly assess where the damage is likely to have been, compared to even at the time of

the Northridge earthquake. There was a lot of damage Santa Monica that just wasn't expected, and no one was going there at first, but now we might have been able to see that in the recording of the data that comes in just a few minutes. Oh look there was a lot of shaking over there. We should go check that out.

So that information is getting better. We're also, as we develop the network sophistication and the number of stations, we're building towards having an earthquake early warning system in California like they have in Japan. And in Japan, they needed that system, and it was very expensive, but because of the bullet trains that they have in Japan, they needed to be able to detect earthquakes quickly and send a warning that can stop those trains. And that's really what we're trying to have here too.

There will be at some point something you'll get on your phone, and part of what we're trying to do with ShakeOut, in some sense, is get people practicing what they would do if they were to get a message on their phone saying earthquake coming, drop, cover, hold on. You know if we weren't practicing that now and that system came out, maybe people would say what? (laughing) What do I do? How do I do that? And if it's a matter of five seconds before the waves come, you can't be trying to think through what does this mean. So, maybe eventually we'll even test the whole system on the ShakeOut day of action each year and have a, you know, use the system to send a message and have people trigger their drills that way.

Cameron: And it's a great, I think it's a great way to get the public to sit up and pay attention. It's a new technology, that's always exciting. And you know you can always kind of look at them and say what would you do with 4 seconds of warning? What would you do with that because that 4 seconds, of course, would save your life. Do you think that we can get there as safety professionals, you and I, reaching out to the public and trying to get people, trying to urge them to be prepared for these kinds of things. Where are we in that? Are we doing a good job? Have we gotten to enough people? Will we survive the next big earthquake well? Southern Californians?

Mark: It's a good question how you asked that, will we survive well. Because for the largest part, we will survive. So even in the ShakeOut scenario, some of the even more catastrophic scenarios, you know, worst case for talking, and it's a bad situation. It's a worst case, right? Maybe 20 to 30 thousand people die. But that's still about less than 1% of the population of southern California. So the odds are that you're going to survive, but what's it going to be like? You know, what's the quality of life going to be? And so what we really want to have people do is what we call to prepare today to survive and then recover. And there's really all that you do before the earthquake is going to determine how life's going to be

afterwards. You know, are the homes in your area all retrofitted so that they won't fall over, or is it just your house? You may be very prepared, but if all your neighbors are not and their homes are older and they're going to fall down, what's your quality of life going to be like? And so it really goes beyond us as individuals in our level of preparedness. We all have to work together. So, are we prepared? No. We're working on it. It's something we'll always work on.

Cameron: I like the way you described that is that maybe we can use a, overuse, a metaphor. You're the pebble that drops into the pond and then all the ripples that go on from there. So, there's you, then there's your family, then there's your neighborhood, then there's your community, then there's your city, and county, and so on and so forth. And being able to impact that is to use yet another metaphor, it's kind of a web. So you touch somebody, who then tells somebody else, who then tells somebody else, and so on. Do I have the architecture right for the ShakeOut and for SCEC's mission to get people talking?

Mark: And we've always encouraged people to share the ShakeOut, to let other people know about it. Like we did in 2013, with My Safe LA and ShakeOut in southern California, Earthquake Country Alliance, at the-

Cameron: Rosemont Elementary School, yeah, yeah.

Mark: Rosemont Elementary that was a great event. That was great practice for the fire department and for the school and also attracted media attention. So then you have, maybe even people who didn't participate or weren't planning to participate that morning, they're seeing the news coverage even before the time of the ShakeOut, becoming aware. And, even if they then don't participate, they're seeing that other people are. The conversation is about earthquakes that day. That's very much part of it too.

Cameron: So 25 million people in 2013 said yes, and they drop, cover, hold on.

Mark: Yeah, worldwide.

Cameron: Worldwide. How many in 2014 you think?

Mark: Well our next kind of level that we're trying to go for is 35 million.

Cameron: Wow.

Mark: And we're looking at, you know, where does, what does that mean that has to happen-

Cameron: Right.

Mark: In each of the regions? And you know, California we've been bumping up against 10 million. You know, it's can we get to 15 million this year? What will it take for that to happen? And a lot of that is everyone talking with each other.

Cameron: Well let's end with a call to action. Where can somebody go and sign up for ShakeOut?

Mark: It's really easy. Shakeout.org and that is linked into all the regions around the world where people can participate in what we call official ShakeOut regions, like California or the Central US or British Columbia. But, we also have set it up to where, even if you're not in one of those official shakeout regions, that you can register in this kind of global ShakeOut, and we had participation in something like 60 countries last year. It's really something that was unforeseen, and we've been kind of hanging on for the ride of it. It's kind of like when you invite people to your party (laughing) and you hope they show up-

Cameron: Yeah.

Mark: Yeah, and yeah, it's like they've been showing up and they've been bringing their friends, and they're like, this party is fun, let's go have a party ourselves. And so, it's really rewarding like that.

Cameron: So shakeout.org. Go to it and sign up. The neat thing, one of the things I love about shakeout.org, it's not just a place for you to sign up. It's also loaded with resources that will help you gather friends, gather your community, your business, whatever together, and do your own kind of drill. You know, make ShakeOut your own thing which is what it's really all about, and that's very much, very much thanks to Mark Benthien and his team here at the Southern California Earthquake Center. So Mark thanks so much for joining us for this My Safe LA-

Mark: You're Welcome.

Cameron: Fire and Life Safety podcast. It was fun.

Mark: Yes.

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