Project Foresight: First Responder Emergency Preparedness & Citizen Response Plan

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The above pictures of family homes taken in 2016 show the aftermath of a natural disaster in geographically separated by hundreds of miles. Over 95 % of structures in these areas were completely destroyed. As bad and wide spread as this disaster was it's scope is small in comparison to what we will one day have to face.

Hazard:
In Oregon, we live next door to a **700 mile long fault zone**. 3 pieces of the earth's crust, specifically the denser Juan De Fuca plate, are being pushed eastward, by erupting magma 180 miles off Oregon's shore. Oregon is sitting to the east on the North American plate. The three smaller ocean floor plates are being forced under the larger North American plate. The area of buried plates is called the Cascadia Subduction Zone. It is about 50 miles wide and in place extends to within just 45 miles off the coast. In this zone, the plates bind up as they try to pass under and over each other. The mounting force causes the top plate to swell. Eventually, the fault line has to release as the top plate slides up and over the lower plate. Subduction zones produce the world's most powerful earthquakes.

Comparison:
Many of us will remember the 1994 Northridge, California earthquake. It occurred before dawn, in an outlying area, about 15 miles NW of Los Angeles. Still, 72 people died, and nearly 12,000 were hospitalized with estimates of damage at 25 billion dollars. All this for a 6.7 magnitude earthquake along a 10-mile fault zone that lasted for only 8 seconds.

Geologists estimate that in Oregon we are due for an earthquake on the scale of **8.7 to 9.2** that will last between 2-4 minutes. *2-4 minutes!* According to the USGS, "The amount of energy radiated by an earthquake is a measure of the potential for damage to man-made structures. For every increase in magnitude by 1 unit, the associated seismic energy increases by about 32 times." So, the difference between a 6.7 and 9.2 is 80 times more energy is released. *80 times more powerful!*

Size of event:
The Cascadia fault line is about 700 miles long and runs from Northern California to Canada. Roughly 50% of the time the whole 700 miles fault line slips however, almost 100% of the time, the lower 350 miles of the fault releases.

Historic Occurrence:
The last major quake is placed in the year 1700. How do we know?

1. Tree rings from ghost forests killed by salt water coming on land place an event in early 1700.

2. Core Samples of tsunami deposits (sand over peat) from the Coos Bay salt flats and estuaries go back 4,600 years and show the last event date to 1700.

3. A huge tsunami that traveled all the way to Japan where the damages were documented was dated Jan 26, 1700.

Using core samples geologists believe that 19 of the last 41 quakes were in the 8.7-9.2 range and 22 of the last 41 were 8.0-8.2 In that time more than a 20 meter slip deficit has developed. That means the plates have the potential to move over 60 feet, not just a few inches.

Just published in August of 2016, using nearly 200 core samples of underwater landslide deposits, left behind by past subduction zone earthquakes, Chris Goldfinger, a leading expert on tectonic activity and

professor of earth sciences at Oregon State and his team, which included scientists from Canada and Spain, have found that the northern sections are "coming due for a shaker." Initial studies were based on as few as 12 core samples. Taking the new data in to consideration, the chances of a quake hitting the central Oregon region in the next 50 years have been upgraded, going from between 14 and 17 percent to between 15 and 20 percent.

The section that runs from Newport to Astoria was previously thought to rupture about every 400 to 500 years, but the new data shows that interval is closer to 350 years. The northernmost section, from Astoria to Vancouver Island in British Columbia, had its quake frequency revised down from an earthquake every 500 to 530 years down to one every 430 years. According to Patrick Corcoran, a coastal natural hazards specialist at Oregon State University, in the next 50 years, scientists believe there's a 37 percent chance of a magnitude 8 to 9 earthquake striking somewhere along the fault line.

What damage will the earthquake cause?

If the whole fault line goes, the initial **death toll** in Oregon alone is estimated at 25,000 and could exceed 100,000 if people are at school, work or commuting. Despite these figures, the earthquake is very survivable. The type of waves that accompany these earthquakes are long rolling waves. Wood framed houses should be able to ride them out. Most initial injuries and deaths will be caused by people being struck by moving or falling objects during the quake itself. What will be hit hardest is our infrastructure: our power, food, water, roads and hospitals. The real emergency for most people will happen during the days, weeks perhaps even months following the earthquake.

The Western States Seismic Policy Council estimates that **399 bridges** will suffer total collapse, **621 bridges** will be heavily damaged and most like impassable. Due to the complete failure of 25% of our bridges, coupled with damage to overpasses and roads, driving could be limited from 3 to 5 miles. 80,000 buildings will be destroyed. Most alarming, over **300,000 students** go to school in buildings that are "**subject to collapse.**" The initial estimated economic damage to Oregon is 31 billion dollars. The full long term financial impacts of this event may run in to the hundreds of billions of dollars. The recent tsunami in Japan caused an estimated $3 hundred billion dollars in damage.

Roads are estimated to be **closed for 3-12 months** and not fully restored for 3-5 years. All access routes, like the 5 freeway will be down. A tsunami that will strike the coast 8-15 minutes after the quake will destroy portions of Hwy 101 along with portions of most of the coastal cities. East - West routes to the coast will be largely destroyed and take **3-5 years to be rebuilt**. All assistance efforts will be staged from the 97 on the eastern side of the Cascades.

Water

During Northridge quake, much of the region's aging water system broke down, cutting water pressure to homes and making it difficult to fight fires. This was not only a firefighting concern, over 10,000 homes in LA were with **out water for more than 5 days**.

Many of our cities' water and waste processing systems maybe subject to failure. Wells may shift and be filled. Wells also require power.

Many electricity lines and transfer stations, phone lines and cell towers will be down. Estimates on repair are from **1-3 months**. However this may be greatly underestimated due to the limited availability of certain transformers and the impassibility of roads. Electricity and some temporary cellular communication were up in 2 weeks after the earthquakes in Japan, Sumatra, Christchurch and Chile. Unlike these quakes where the damage was limited to a city or single region, this quake could affect ten's of millions of people in 2 countries and 3 states along the 700 mile fault zone.

According to the Western States Seismic Policy Council we face a greater problem in that our systems are dependent on each other. We can not fix the power and phone lines until we have usable roads, we can't fix the roads until the bridges are fixed and debris cleared and we can not fix the bridges until we have liquid fuel. Unfortunately, all of our **liquid fuel** runs from Portland south and crosses 15 rivers including the 1930's bridge over the Columbia River. Except what is brought in by helicopter it is estimated that the public could be **without normal fuel supplies for 6 months.** In short, we can't get liquid fuel until the bridges are fixed but we can't fix the bridges without fuel.

According to the Food Marketing institute consumers go to the store grocery 1.6 times a week. Most households have less than 1 week's worth of food on hand. In addition, groceries stock less than 3 days worth of food for the residents that they cater to. Take Jackson County for example, over 95% of Jackson County's food is trucked in, that coupled with the fact that all of the grocery stores combined do not stock enough food for the 206,000 residents of the county to eat for more than 3 days means that there will be widespread food shortages.

What to expect on the coast - Tsunami

When the upper plate lifts, it will raise an elongated pile of ocean water 10 to 20 meters or 30-50 feet above the surface. Simultaneously the quake drops down most on-shore regions by 1-2 meters or 3-6 feet. This water pile and the energy released will divides half heading to sea and the other half racing towards the coast. The waves will compress as they reach shallow water and raise in height. The tsunami waves resulting from Japan's 9.1 earthquake where a 50 mile wide strip 180 miles long was lifted 50 feet in the air. Within a half-hour, the waves arrived on Japan's coast, some over 130 feet tall, plateaus of water that surged up to six miles inland and unleashed much of the devastation that killed 22,000 people.

The waves resulting from a subduction zone earthquake off of the coast of Oregon will arrive with in 8-25 minutes. Computer models vary but the old prediction of 30 feet has been greatly increased to figures of **100 feet even 130 feet** by the computers models run by the National Oceanic and Atmospheric Administration in Seattle. Rivers mouths, drainages, flood plains, beaches and similar low level terrain features will be in undated with water. High waves can last 10-12 hours and even up to 72 hours. The shaking and subsequent aftershocks may trigger landslides on and off shore.

What should we do?

When I was a RVSAR Board member at a meeting I asked the question to the RVSAR board, "What is our communication plan in the event of a major emergency, were we to loose power and road access? How do we contact our 100 members?" We really did not have an answer. Which lead me to the question: "What then is our role as first responders in the event of such an emergency?" Again there was no answer.

This disaster could be **so wide spread** that there will not be immediate EMS or assistance available. I attended in a meeting of state, county and responders, law enforcement officers and hospital employees where it was stated but the instructor that it was understood that most if not all EMS will see to the needs of their immediate families and would not be responding in the first several days to a week after an event and even those that can stay on duty, can't work 24/7 and due to roads being down, most likely won't be able to get out to most areas. People will have to be able to fend for themselves for an extended time period or die. Simple as that. Just look at the natural disasters all around the globe. It happens all the time. Just because a disaster has not happened here in our living memory, does not negate the fact that it has happened here 41 times before and will happen again, probably within our lifetimes.

Remember the estimate of a 37 % chance of a great than a 8.0 earthquake somewhere on the fault line and between 15-20% chance of an 8-9.2 earthquake in the next 50 years. We buy all types of insurance and make contingency plans for events that percentage-wise have a much lesser chance of happening. The term Normalcy Bias refers to a mental state people enter when facing a disaster. It causes people to underestimate both the possibility of a disaster occurring and its possible effects. This may results in situations where people fail to adequately prepare for a disaster, and on a larger scale, the failure of governments to include the populace in its disaster planning. Perhaps a better way to look at it is to bring it closer to home.

What if it happened tonight?
How much food do you have on hand at home? How much stored drinking water? Enough for a month? What if your family and neighbors show up, in winter after a big snow like we just had and you have not power water or road access? Do you have a means to cook your food with out electricity, keep cool, keep warm? What about fire fighting, security, communication, hygiene, dealing with sickness dead bodies and waste disposal, medical treatment, heating, basic shelter rebuilding like covering broken windows? By asking you to think about your own level of emergency preparedness my hope is that you will see that, if even those in the know, have work to do, how much more the average Oregonian? On to the plan.

Residents Preparedness Plan
Studies show that 95% of those rescued in a disaster are saved by family members, neighbors and strangers. We are going to be called to respond to our neighbor's aid and them to ours. So, we had all better have our own houses in order. Where do we begin in education ourselves and our neighbors on how to to prepare and deal with a reoccurring disaster of this magnitude. There are many groups nation wide like the Red Cross, COPE and CERT that are providing great training to citizens and focus on citizen emergency response and preparedness. These are a good thing and I fully support them. Widespread implementation of these plans is one problem, the another is that most focus on the first 3 days of a disaster not an extended recovery period and assume that EMS services will quickly be up and running. What we are facing is not a short term interruption of our services. Even more aggressive plans like the “2 Weeks Ready” program which offers some great overview suggestions are too short in span, don't walk people through the nuts and bolts of what to do and how much to put away for an extended time. This program is not designed to compete with any of these programs but to work in conjunction with them.

I originally wrote this plan for Jackson county in 2014, so it will serve as an example that could be scaled to all counties in Oregon. Jackson County is not prepared to handle a large scale disaster such as a mega thrust earthquake from the Cascadia Subduction zone. Our 754 page county plan is a basically a copy of a generic plan for the rest of the counties that does not specifically reflect the assets and issues that Jackson County has and will face. It is huge NIMS /ICS document that focuses on who is responsible for cleaning up what portion of what ever mess may happen. SOPs and clear span of control and integrating agencies are all essential and I believe that the United States' NIMS/ICS is far superior to the Cluster System used by the international NGO community, but the first two weeks of a large scale disaster are often controlled chaos. Little if any thing in our county plan prepares the residents to be self sufficient for an extended period of time or clearly instruct our state trained first responders what to do during, immediately after and in the weeks after the initial earthquake.

This plan is to supplement the training and continuing education of all state and county trained first responders in the concept of each responder taking an active role in the preparation and emergency

oversight of the neighborhood that the responder lives in and at the same time educate and encourage the people of Oregon to be self-reliant for 30 days following a major disaster.

The subject group of this hypothetical example are the first responders of JCSAR who's training is provided for by the county and the state government. Due to the nature of the disaster, we have established that power, water, commercial communications will be down and travel will be practically impeded. These local first responders, who are trained to travel to a station, department or hospital where they act as part of a team, will find themselves stuck in their on neighborhoods and will be faced with the decision to respond to their neighbor's aid without their usual trained team members to assist them. These first responders will most likely find themselves working with ad hoc teams to help their neighbors in the event of a disaster. This plan focuses on improving on the effectiveness of the isolated first-responder by training the responder to personally prepare for such an event in such a way that his or her immediate family and neighbors are safe and secure so that he or she will be free to respond locally to give aid to those in need. Further, long before the disaster hits, the responder identifies who in the responder's neighborhood might be an emergent volunteer in a disaster and introducing them to a state created on line training program which walks them through getting their family prepared for a long term disaster.

How it works:
Jackson County Search and Rescue has 100 volunteers. Each member would be responsible for the emergency preparation education or direct provision of 10 other people. This is called his or her "base." This includes the responder's immediate family members and the neighbors on each side. The final 2 members of the responder's bases will be carefully pre-selected emergent volunteers that live near the state trained first responder called "neighborhood team members" who are willing to assist the first responder in their own neighborhood in the event of a disaster. The emergency preparation education consists of a video series hosted on publicly accessible and autonomous website that will cover the fundamentals of response to and emergency preparedness for a large scale re-occurring disaster. The video series will walk a average family of 4 over the period of 1 year, guided subject experts as they prepare them to respond to the disaster and teach them how to be self-sufficient for the first 30 days following such a disaster. The responder introduces the concepts and training to the base members and periodically checks with the base members to encourage progress.

Example:
I am married with 2 boys, that's four. I have helped my neighbors on each side get prepared that is eight and I have chosen 2 team members, Pete and Terri, two capable people in my neighborhood who I would want to have around in the case of a disaster. They are the members of my team. As I am the trained first responder, I am team leader. Now my two teammates also have families, and as they don't live right next to me and it might happen that they can't get to me right away because Tom and Terri each need to see to the needs of their own immediate family and neighbors. So, it is imperative that not only myself and my family be prepared, Pete and Teri's family and neighbors also need to be considered too. Once the needs of there own families and neighbors are safe and secure, the two volunteer team members and I can turn our attention to others in our neighborhood. If I can help Pete and Terri to get prepared and they can in turn help their own families and immediate neighbors, the response time greatly reduced and general availability of ad hoc team members is increased.

This is phase one the **Responder level**. Around 30 people have been accounted for per first responder. Multiply this by the 100 JCSAR members who also follow the plan in their neighborhoods and this could roughly equate to **3,000** people.

Now, let's assume that my two friends Pete and Terri have realized that many of the families that live on their street are unprepared and that they may have to share the resources they have put away for their own families with these unprepared neighbors. They are encouraged by the initial first responder, to reach out to their neighbors and reproduce the team at new level. Pete and Terri also select 2 of their most reliable friends / neighbors to be part of their own team. Now two sub teams or **street teams** with 2 team members each have been created. Those four new team members are also responsible for their own base and once their families are safe and secure, they can turn their attention to their neighbors.

This is phase two, the **Street level**. Around **70** people have been accounted for. Multiplied by just the 100 SAR members, that is 7,000 people nearly **3 ½ %** of the county's 206,000 population.

The third phase where the process is repeated for the third time is the **Neighbor Level**. This is plugging the holes on the street for people that are not prepared. At this level 150 people have been educated and accounted for. Multiplied by the 100 SAR members, this is 15,000 or 7.2 percent of the population of Jackson County. Multiply that by all the trained first responders in the county and suddenly we are accounting for a respectable percentage of the county's residents. These are 15,000 people who will be assets in the aftermath of a county-wide disaster instead of people requiring assistance. 15,000 who are not requiring government resources and are in a position to help. These numbers will be greatly bolstered by advertising the program to the general public and the encouraging other service groups to use the plan like the Boy Scouts of America, OHA and RMEF. Perhaps most importantly, it leads to a spirit of cooperation and reduces fear based responses like panic buying and civil unrest that happens when the unprepared suddenly realize the danger they face and purchase more than they need out of the fear of scarcity.

This sounds like a bit over whelming, but it is really just the responder getting his or her family and immediate neighbors prepared and getting two neighborhood friends to do the same. Then they repeat the process. The state of Oregon is responsible for the training and continuing education of thousands of certified first responders: State Troopers, Sheriff's offices, Fire Departments, Volunteer Fire Depts, EMTs, RNs Pas, Doctors, Search and Rescue units, National Guard units ODF, ODFW, State Park Rangers, Retirement medical service providers and regional hazmat emergency response teams. If the state and its counties require a license or certification then the state can require training and direct implementation. A culture of civic responsibility in the event of a disaster of this scope needs to be fostered.

Video Series

Information about the the Cascadia Subduction zone is publicly available and the internet is packed with information about emergency preparedness but it is spread across the internet and takes hundreds of hours to sift through it all and it takes discernment to weed out erroneous information. It should be in one place, easy to find, logically and progressively organized, publicly and anonymously accessible. I propose a training video series of 14, hour long videos created and hosted by the State of Oregon on a publicly accessible website covering the fundamentals of how to prepare for and respond to the disasters we are likely to face here in Oregon. Pdf files of diagrams and plans will be available for free download from the same site.

The goal of following the plan presented in the video series is to prepare neighborhoods, streets and families to provide for their own rescue, medical care and food and water and shelter for the first 30 days following a large scale disaster. All presentations will appeal to the practical and easily achievable. You can prepare on any and even no budget at all, however, video series plan will encourage a family of four to budget $20 a month for a year, totaling $240.

Our first responders don't have to be experts in the material and don't have to teach anyone, they just have point them to the information and periodically follow up with them to see how they are coming along in the video series and in implementing the ideas provided.

To recap, we have to have our EMS responders in the field after a disaster, and based on best scientific predictions, that field will be their own neighborhoods. We need to anticipate the scenarios that would prevent them from responding and make plans to preemptively mitigate those problems. These problems will start with the well-being and security of the responder's immediate family and immediate neighbors. Creating a neighborhood response team is the next step. It order to do this, the same set of problems will need to be addressed for each neighborhood team member. Each person that responder helps to get prepared reduces the drain on his or her own resources: not just provisions but time and mental energy as well. This frees up the state trained first responder to utilize his or her training in an effective manner when isolated from his or her agency. Ultimately, this reduces the overall burden on state resources as it provides for its citizens in the aftermath of a disaster.

Project Foresight video: A separate video made specifically and accessible only to state trained responders outlines the plan as described above.

Publicly available videos:

Video 1: What are the facts about a Cascadia subduction Zone Earthquake /What to expect and immediately following a quake

What is the Cascadia Subduction zone?
What will different parts of the state experience?
How are most people injured. Identifying hazards
How to secure your work place and home.
How to get home after a Disaster. Pre-planned route that your loved ones know about.
What to keep in your car. Meeting / rally points. Note boards and communication if power is down.

Video 2: Shelter

Identifying hazards
How to secure your work place and home.
Storage sheds for tents sleeping bags cooking gear in case of fire or collapse of main dwelling
Simple modifications to outbuildings so it will be ready to convert to a temporary shelter.
Tools and Materials to keep on hand for repairs and building
What is likely to break. Know how to shut off water, power and gas and have the right tools
What raw materials to have on hand. Plastic sheeting, Gorilla tape, roofing nails 2x4s, plywood.
Tools: Rechargeable tools, hand tools old school hand tools drill. Hand saw hammer nails wrenches screw drivers Roofing tar PVC pipe, assorted fittings, hack saw and glue (dries so rotate)
Fire wood processing tools, fire tools gardening tools, fencing tools, post hole digger.
roofing tar

Video 3: Water

How much to store per person per day. Methods of storage. Large vs small
Shutting off water main to prevent contamination. Hot water heater - Legionnaire's Disease
Water borne bacteria and protozoa. Boiling, Sterilization, Filtration and Purification: UV and Chemical treatment. Catchment systems, hand pumps Ram pumps Piston pumps.
Bailing bucket and rope for non-op wells. Grey water disposal

Video 4: First Aid in an emergency

Helping others: Good Samaritan laws - Volunteer Protection Act
Your prescription and back up medications and documentation
First Aid books: get trained and certified. Most common injuries and treatment
Medical Kit: Dollar store supplies: Gauze, lots of it, different sizes and rolls. Tape, Band aids, peroxide, alcohol, gloves masks, medical scissors, Sam's splint peroxide, Ace bandages, tourniquet, tweezers eye flusher CPR masks, Anti diarrhea medicine, Gatorade electrolytes aspirin, Benedryl triple anti-biotic ointment, 40 inch square for sling, Cheyenne pepper improvised triage: making bandages, sheet, plastic sheet, towels, paper towels

Video 5 Food: Part 1 Food Storage

How much per person per day. Differences between men and women
Calories, Vitamins and minerals. Example of Sarajevo: secondary infections due to malnutrition.
Food Storage. Lists. Rotation: first in first out. Box store supplies vs online bulk food sources MRE's
Food Storage, cataloging and rotation. DIY storage: 5 gall food grade buckets, Mylar bags, vacuum seal. Sealing mylar with hair straighteners and oxygen purging with hand warmers.
Canning, sour kraut, bulk grain rice and beans. Vitamins and minerals.

Video 6 Food: Part 2 Food Preparation with out electricity

BBQs and camping supplies. Tools dutch oven, flour grinder, can opener, hand whisk and sifter.
Baking supplies salt yeast baking powder / soda. Recipes for bulk supplies, flat / peasant bread
Cooking with out electricity: Rocket stoves Store bought vs cinder block DIY. Wood stoves and cast iron dutch ovens. Aluminum foil and 3 basin dish-washing Fire pit cooking, dehydration and smoking.
Solar ovens Cold Food Storage: Chest freezers instead of refrigerators, water evaporation coolers, root cellars

Video 7 Power and Lighting

Lighting: Candles, propane lamps, oil wick lamps, matches, solar garden lamps LED bulbs, and hand crank lights. Batteries: storage and safety hydrogen gas fire
Generators: fuel storage and safety. Maintenance Oil and filters noise reduction
Auto Inverters: 12v to 110. Solar: Small cell phone and small electronic solar charger with lithium battery. Medium Harbor Freight systems. Large home systems non-grid tie power back ups.

Video 8 Alternate Heating and cooling

Blankets, Wood burning stove, 2 cords of dried wood and kindling. Kerosene heaters. Fuel storage white gas and catalytic heaters for outside. Indoor Gassifiers. Soap Stone heat and take to cold rooms. Danger of exploding rock. Moving everyone to one room to conserve fuel

Video 9 Fire Fighting

Firefighting:
Fires from using lamps and stoves after an emergency. Buckets, Extinguishers fire blankets
Separate fire tool storage: Shovel, Ave, Mattock, Breaching tool. Gravity fed tank ½ hp pump
Neighborhood plan. Defensible space. Proper liquid, gas and solid fuel storage

Video 10 Communication

Comm plans: family and neighborhood message boards and periodic check ins.
Comm plan for first responders and neighborhood, street level and neighbor teams

Scheduled neighbor check ins, Radio AM/FM extra batteries hand crank
Short wave RX only scanners (trunked systems) WX brief
HAM radio and ½ watt local neighborhood broadcasting
CB and family band radios military crank phones
HAM radio network and emergency broadcast locations

Video 11: Money, Barter and Document Preservation
No ATMS so keep cash on hand: how much and what denominations.
Barter items: food, water, building materials, alcohol, toilet, paper medical supplies, batteries, candles nails and building materials, skilled labor, silver?
Documentation Preservation:
Scan and save hard drive and important docs: deeds, medical information, account numbers, contact numbers, prescriptions, insurance info to a 64 gig jump drive. Keep original passports SSN and deeds etc in fire safe. Keep current fliers with family members description and picture and contact information in safe for missing person. DIY fire safe plans.pdf

Video 12: Security
neighborhood and street security, check in times, security patrols
helping others now expands your safe areas and extends your resources.
Security assessment sheet, reaction time security plan
Deter-fences, dog, "looking small," grey man
delay, locks hardening your home and outbuildings, safe rooms
Dissuade, home defense, know the laws weapons training
Historical examples of violence in disasters
Traveling in groups, curfew, martial law, no law

Video 13: Waste disposal, death and disease
historical examples of sickness, death after disasters
Water contamination dangers, Sewerage handling garbage disposal
dead bodies, bury, burn, lime? safe handling practices Legal ramifications : document everything

Video 14: Gardening and long term planning
Local gardening book, master gardening classes. Non-gmo seeds plant a garden soil sources raised beds aquaponics green house, protection from bugs and critters (both the 2 and 4 legged kinds)
Psychological benefits of gardening during stressful times. Aquaponics plan.pdf

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American Red Cross

Earthquake Country Alliance

National Science Foundation

National Institute of Standards and Technology

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