Emergency Preparedness And Your Water System

Part of a series of documents created by Tim Guishard Enterprises discussing relevant subjects in the groundwater industry.

This document details facts about issues with water supply systems on Private Property during an emergency.

INTRODUCTION:

There are three major events in San Diego County, which will render most private water systems useless. These events are forest fires, earthquakes, and terrorism. Many people have partially planned for some of these events, by adding generators or the ability to connect their pumping equipment to a generator. Some people have purchased gasoline powered pumps. Very few people have prepared for the most likely events.

Wildfire Preparedness

Wildfires occur regularly in San Diego County. Right after the Wildfires in 2003 and 2005, we replaced dozens of plastic tanks with steel tanks because they plastic tanks looked like this after the fires:

How soon people forget about how poorly these tanks perform during these events! You have no fire protection if your tank is not usable for an event like this.

Keep brush trimmed back at least 50' from plastic tanks, and 25' from steel tanks.

Here is an example of a well that will have major failure during a wildfire. The plastic piping and electrical will be damaged.

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While terrorism in San Diego, will probably not be directed at a specific well, it will be directed to the major power grids.

The well here has been designed with fire and terrorism in mind. The well's equipment is located inside a fire resistant fiberglass building. It is equipped with an automatic backup generator, which is started on a regular basis. The brush has been cut way back, and the grass is mowed several times a year.

Like the well above, this well is prepared for a fire, as there are no combustibles located anywhere near the well. Not shown in the picture is the automatic generator.

Both of these wells are also prepared for freezing conditions, with the insulated building on the well above, and electric heating cable and insulation on piping for the well to the left.

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Earthquakes:

Earthquakes can knock out the power to wells and pumps and can also do major damage to water tanks, and cause fires to start. Below are examples of earthquake damage to water tanks from around the world.

These are examples from the 2010, 7.0 magnitude earthquakes in Haiti:

☛ The foundation supporting one of these tanks failed, and then pipes leading into and out of the tank were broken.

☛ The tank in this example, moved several feet, again breaking the piping to the tank.

Both of the above examples are fire protection tanks. How well do you think these fire systems worked at putting out the resulting fires in the structures they were supposed to protect?

This 500,000 gallon tank to the left was severely damaged by a wave inside the tank, causing major structural damage to the tank. Even though this tank was anchored, the design of the anchors allowed the tank to lift several inches.

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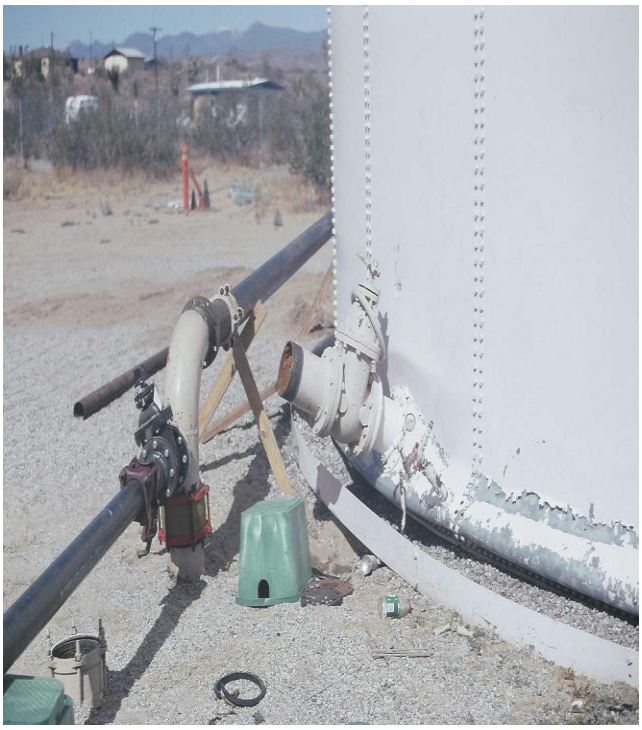
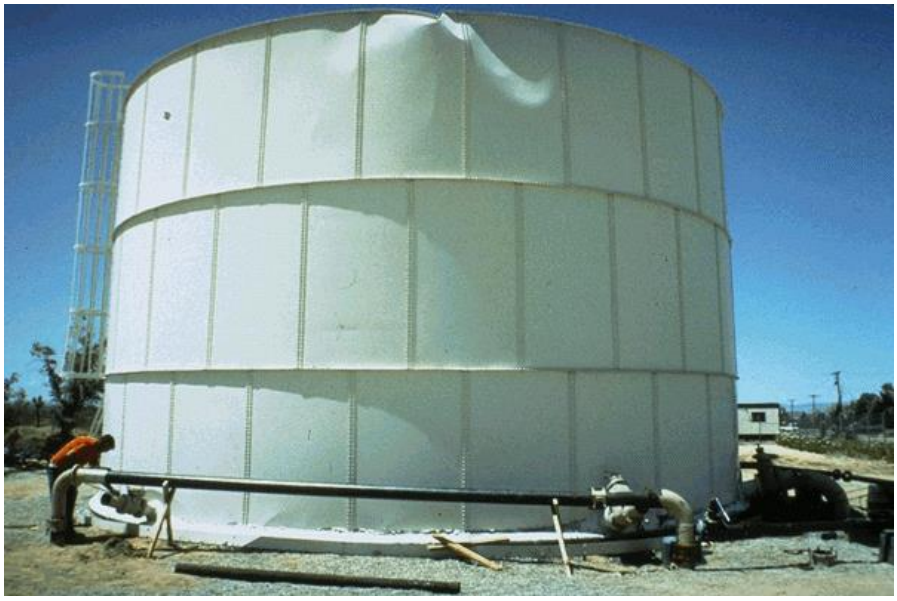


These examples are from the 1992, 7.6 magnitude Landers earthquake just north of San Diego County.

This multi thousand gallon water tank actually jumped several feet in the air, resulting in broken piping and caused major structural damage to the tank. The tank is now about 12” shorter due to the compression damage that “elephant footed” the tank walls.

The community’s fire protection was compromised as well.

Notice the damage at the top of the tank as well; where the water in the tank pushed up on the roof (which is what caused the tank to jump). Luckily the tank did not split open, and they were able to get the valves shut down. Reports say; People lined up to fill buckets from this tank for several days after the event.



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Don’t think that damage only occurs to large tanks. Here are some more examples of tanks that could be at anyone’s home.

This damaged tank was damaged in the 2010, 8.8 magnitude earthquake in Chile. This tank looks to be about 10’ tall and 8’ in diameter. It was anchored, and the liquid in the tank sloshed causing the structural damage. We do not know if the tank was designed for this type of seismic loading.

The tank below is from the 1908, 7.8 magnitude San Francisco earthquake. Looking from the man standing next to it, the tank is probably about 12-15,000 gallons.

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All that was left of a 100,000 gallon tank from a 6.9 magnitude earthquake in El Centro, CA in 1940

Don't for a minute think you poly tank is exempt from damage!

AND, the poly tank sales people say: "you can simply reconnect your tanks to the piping after an earthquake!"

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What can you do to make your water system better able to be usable, or just survive, after a; wildfire, seismic, or terrorism event?

- Clear brush and weeds at least 10' away from your well head, pump equipment, and storage tanks.
- Pour a concrete slab around your well head. BTW: This has been a code requirement in California since 1974 and very few people have one!
- Don't store flammables, gas cans, paint, lawnmowers, etc., in your pump houses.
- Install and maintain a propane, or diesel powered generator, to power all your pump equipment. This may require running wires to electrically separate your house, garage, or barn, from the pump equipment. You don't want to have your pump powered by wires that run through a burning building! Make sure to anchor that fuel tank as well!
- Never install a booster pump system inside a garage, or even within 25' of a house or any other building. Instead, follow NFPA Standards and install the booster pump in a separate building that is constructed with fire resistant materials.
- Fire-harden your pump houses with: cement fiber or metal siding, and metal roofs.
- Anchor your tank to a properly designed foundation. ***However, beware that there are tank manufacturers out there that do not use formulas in their designs that represent what happens in a water tank. They are using formulas from the UBC for a semi-fluid solid like; rice or corn.*** Insist that the tank you purchase be designed using the universally recognized formulas in the ANSI/AWWA or NFPA design standards for water tanks.
- Use flexible connections between the tank, and external piping. This way even if the tank moves a little, the piping hopefully will still be connected. This is even good to do on piping leading out of the well head, or in and out of booster pumps.
- Increase the freeboard (lower the high water level) in your water tanks, and install an overflow to make sure the water can never go to higher in the event of equipment failure. In a tank as small as 12' in diameter, and 8' tall, AWWA and NFPA calculations show that just over 20" of freeboard is required to limit structural damage to the roof of the tank, when the water either jumps or sloshes inside the tank. On larger tanks, more freeboard is required.
- Anchor even your pressure tanks to something structurally stable, like a concrete floor.

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Some examples of seismic anchoring or flexible connections:

Simple angle iron clips are bolted to this pressure tank's bottom and the concrete.

Anchor brackets for poly tanks are bolted to the concrete, then cables are attached that either:

- go over the tank to another bracket,
- Or up and around slots cast into the tank's roof and back down to the same bracket.

Because of cable stretch, these are not real sturdy, but better than nothing. The roof of the tank may actually be cut by the cable in a seismic event.

In this example, brackets are bolted to the shell of a steel water storage tank, and attached with a long bolt cast into the concrete.

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This “flexible metal hose” is ideal to make flexible connections to tanks, pumps, or wherever some piping flexibility is required. They can withstand heat, cold, and high pressures. These are available in sizes from ½” to 6” and even larger.

Simple, flexible, PVC pipe can be used where it is not exposed to mechanical or physical damage. Degrades quite fast in direct sunlight, and becomes brittle with age. Valves on each tank allow the pipe to be replaced without draining the tanks. Like above many sizes are available.

“Flex-Tend” connections allow for a great amount of movement, without piping damage. These were originally created in Japan to mitigate seismic movement not only on water tanks, but buildings and pipelines that cross fault lines.

Flex-Tend are available in sizes down to 2”.

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