How Does the Technology Work?

It's not hundreds or 1000s of years old, but it is based on a typical Roman cement. We've simply modernized it to meet today's expanded construction applications.

Essentially, the material relies on an alternate method of activating the siliceous/aluminous material that you would find in a pozzolan. So we can use almost any source of pozzolanic materials — slags, volcanic ashes or natural pozzolans. There is no need for the clinkering process, which is the main culprit for the staggering 9% of global CO_2 emissions that are attributed to Portland cement.

The technology uses a brine activator, which is a combination of various salts that can be found in seawater. As soon as that material begins to solubilize, atmospheric carbon dioxide (from the air) begins to dissolve into the water until it reaches equilibrium. As that carbon dioxide is dissolved in the water, an acid base reaction starts to occur, precipitating various solid carbonates and consuming CO_2 in the reaction. Meanwhile, the brine is blended with pozzolanic materials, which are predominantly siliceous materials that will react in the presence of an alkali environment to form silicates.

As these materials solubilize, dissolve and react, a skeleton begins to form because there is a fair amount of magnesium and calcium present in the brine. Instead of calcium silicate hydrate, which is the glue that derives from Portland cement, these reactions form ***calcium alumina silicate hydrate*** and ***magnesium alumina silicate hydrate***. These materials are rapidly forming. They depend on having a certain concentration of calcium or magnesium in the water before they get moving, hence the purpose for the brine.

The silicate hydrates begin to grow on surfaces, and eventually, the two surfaces that are near one another will begin to join in a similar fashion to the way that calcium silicate hydrate (without alumina in it) forms in Portland cement. The entire time that the material is plastic or moldable and afterwards, it's still absorbing carbon dioxide — both the calcium aluminum and the magnesium aluminum materials as well.

As more of the slag or other pozzolans solubilize, ***calcium silicate hydrate*** will start to develop, the same glue that holds things together in Portland cement. These reactions also uptake carbon dioxide.

Ultimately, Partanna materials do end up with both the alumina silicate hydrates and the silicate hydrates that are typically formed from the reactions of Portland cement or other pozzolanic materials. It's just the way in which they're formed don't need to be precalcined and then changed to calcium silicates, which are highly soluble in water and highly unstable and the source of Portland cement's high environmental costs. As a result, Partanna has a significantly high net carbon absorption, resulting not only from avoiding CO_2 emissions but also from removing CO_2 through mineralization.

Sets in a similar fashion to Portland cement. Unlike many new cements that claim to be "low-carbon", Partanna has normal setting characteristics that meet or exceed the expectations from Portland cement.

Works nearly as a drop-in for Portland cement in terms of equipment. The process does not have significantly different requirements for equipment or conditioning from conventional concrete. The main difference is that rather than using water, there is a brine surge tank with material dissolved in it. That is mixed in a conventional mixer with whatever pozzolanic, siliceous and aluminous material, as well as with aggregate.

No CO2 bottling or injecting required. It's not carbon sequestration that you may be used to or may have seen. We're not injecting CO_2 into our mix. Rather when the mix cures, it consumes CO_2 from the air. So, we do not have emissions associated with bottling or transporting CO_2.