

Technical Bulletin 0013

Subject: Why the Use of Backfill Around Reference Electrodes is Obsolete & Detrimental to Obtaining Accurate Readings

In response to many requests for information regarding the need for backfill to be used with the **Stelth[®]** reference electrodes – we offer the following:

With the development of the **Stelth 2[®]** concept we have eliminated any need for backfill, which would include 20-minute casting plaster and other varieties of backfill such as bentonite. All of these have proved to be detrimental to the overall performance of the reference electrode. Bentonite has metallic traces in it, which causes **potential shifts** and contamination of the reference cell. Bentonite and 20-Minute casting plaster are also hygroscopic and will draw moisture from the reference electrode, dehydrating it, thus shortening the life of the cell and amplifying any IR drop problems that exist.

In addition the 20-minute casting plaster acts as a repository for chlorides that are thrown on the streets in metropolitan areas during the winter months. This of course intensifies the attack, by chlorides, on the copper sulfate chemistry of the reference cell, especially when the cell is encased in this cocoon of plaster.

The original reason for the use of the bagged backfill was to provide a low resistance transition from the sensing area of the reference electrode to the surrounding environment. This sensing area was approximately one square inch. The **Stelth 2[®]** has over 33 square inches of sensing area, which is over thirty times more sensing area than the old fashioned reference cells which are manufactured today the same way they were over 40 years ago (see comparison chart number CC-0001).

In most engineering circles in the Americas, Europe and the Middle and Far East it is generally accepted that the best practice is to have the reference electrode resident in the same soil or water environment as the structure being read. The use of Backfills alters this practice.

It is interesting to note that some companies are still using wooden plugs for their sensing area. When wooden plugs dry out, the pores of the wood close and can never be reopened no matter how long they are soaked in water. Also, wooden plugs, cannot be cleaned by flushing them out with water. All of the **Stelth[®]** reference electrodes use a medical grade ceramic with a fixed porosity that will not close and can be cleaned with soap and water anytime that it would be required. This of course is important for portable cells such as the **Stelth 3[®]**.

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The expanded sensing area allows the **Stelth 2[®]** to operate at a three-micro Ampere level. This is due to the increased sensitivity that is created by the enlarged ratio of sensing area to the copper element. In addition to this feature we have developed a patented ceramic body that has embedded in it a **Moisture Retention Membrane MRM[™]** and a **Dual Chloride & Hydrogen Sulfide Ion Trap[™]**. The **Stelth 2[®]** technology provides a “**Molecular Sponge**” (ion trapping shield) that prevents both chloride and hydrogen sulfide contamination under virtually all operating conditions.

The **Stelth 2[®]** technology provides **INDEFINITE SHELF LIFE** – the plaster-bagged technology provides a shelf life of from 1 month to 12 months depending on which company makes the cell.

The **Stelth 2[®]** technology also affords you the ability to accelerate your installation process and to minimize the cost associated with reference electrode installations.

The old practice, when using a bagged reference electrode weighing between 18 to 22 pounds (8 to 10 kilograms), of having to excavate a hole 3 to 5 feet in diameter by 3 to 5 feet deep (1 to 1.75 meters by 1 to 1.75 meters), lay the reference electrode on it's side pointed at the structure, drowned it in bucket after bucket of water and wait several hours for it to activate is no longer necessary or economically feasible.

Today with the **Stelth 2[®]** reference electrode, weighing less than 2 pounds (1 kilograms), it is only necessary to bore a 2” hole to the depth desired, drop the **Stelth[®]** in the hole, throw a bucket of water in the hole to activate the electrode immediately and backfill the hole. Simple as 123.

Testing a reference electrode after it has been bagged with backfill around it is impossible because the backfill material would harden when subjected to water. It is important for the cell to be tested in it's final state to insure that it is fully functional when it is installed. Having to reinstall a dead cell is expensive.

One of the big problems with bagged reference electrodes occurs after they are assembled. Some of the fluid in the electrode begins to leach into the plaster surrounding the sensing area. After a short time this plaster hardens and will have a tendency to break loose from the surface of the sensing area, especially if jarred from dropping in shipment, causing an open circuit, which renders the reference electrode useless.

We currently have in excess of 180,000 units of the **Stelth[®]** electrodes installed in 121 countries around the world. Although this product comes with a 30 year guaranteed life, we have no reason not to believe that they will work much longer than that.

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