

## Corrosion Under the Fire Protection on Sphere Legs May Threaten Sphere Integrity

Corrosion may be active below the concrete if water has penetrated. Over a period of time, the corrosion damage may threaten the structural integrity of the legs.

The legs on the sphere to the left failed during water filling for a hydro-test, as a result of corrosion damage under the fire protection.

Acoustic Emission (AE) monitoring of the legs during filling will indicate if damage is occurring. This allows the integrity to be continuously monitored, and the filling to be carried out safely. Only one sensor per leg is required.

Inspection in advance of filling is often preferable. However, the removal of the fire protection is costly and usually unnecessary; and its replacement may result in inferior bonding to the original. A number of alternative methods are available. Those offered by Physical Acoustics include:

1. AE monitoring for active corrosion: This method can be used without insulation removal. It is also useful to find out if waterproofing repairs have been effective.
2. Impact-Echo: Identifies if the bonding between the concrete and the steel leg has failed. A good bond prevents water ingress.

The following example shows these methods in service (ask for our method statements).



The test equipment is close to or within 100m of the sphere and is connected to the Acoustic Emission sensors by cable. The special acoustic



corrosion sensors are mounted near the areas where water ingress is possible. They detect Acoustic Emission coming from active corrosion, a technique used routinely to test process plant and tank floors. Follow-up inspection is required to assess the extent of damage when active corrosion is identified.

The legs are first tested “dry.” Then testing again, after wetting to stimulate corrosion activity if water ingress is taking place. Suitable methods of wetting include using the deluge system as shown, or a water hose.

The AE test system may be a portable, battery-powered system to test one leg at a time, or a larger system to test all at once.

The Impact-Echo method is then used to identify areas that lack the bond between the protection





and the leg, which allows water to be present and cause corrosion. The test is usually carried out on a 200mm grid, each point test taking a few seconds. If bonding is good, then corrosion between the leg and protection is not possible. The impact-echo method uses a special transducer that is connected to a signal processor and notebook computer to analyse the acoustic response to mechanical impact of a known controlled duration.

**Primary Acoustic Emission Testing:** The primary test finds defects in the pressure shell and leg attachments. The industry name for this is MONPAC® testing. Monsanto Chemical Co. and Physical Acoustics Corp. developed the MONPAC method by adding 5 - 10% over pressure to a vessel to see if defects are present. AE sensors can very accurately triangulate a small defect location from several meters away. MONPAC® can also grade defect severity. The test can be safely conducted well before permanent deformation or catastrophic failure happens. Extremely small defects give off a great deal of Acoustic Emission. There are also ASTM and ASME codes for use of AE on pressure and atmospheric. Our newest software design will take this one step further and incorporate Fitness for Service (FFS).

### **Benefits of AE Testing:**

**Global Monitoring** - Sensors detect AE signals from considerable distances, making this method ideal for global monitoring of large vessels and systems. Identified problem areas can then be inspected using other NDT methods.

**Minor Disturbance of Insulation** - Only small holes in insulation are required for sensor mounting. On high-temperature applications, waveguides are used to contact the surface. Sensors are then mounted outside the insulation.

**On-Line Testing** - For most storage vessels, on-line testing is possible either by filling it with product, introducing gas into the vapor space, controlling the temperature or other process parameters.

**Cost Reduction** - The use of AE can reduce plant maintenance costs considerably, while increasing the information available about plant integrity. Plant downtime for inspection is also minimized.

**Rapid Inspection** - The actual AE test takes a matter of hours, and in some cases, considerably less. No comparable method can provide 100% volumetric inspection in the same amount of time.

**Permanent Record of Test** - Data is digitized and stored on disc, providing a permanent record of the test that can be re-analyzed at any time.

195 Clarksville Road, Princeton Junction, NJ 08550 USA  
Phone: (609) 716-4000 • Fax: (609) 716-0706  
Email: sales.systems@mistrasgroup.com • www.mistrasgroup.com