The SafeStorage System

Water activity has long been recognized as an important component of product quality and safety. Decagon Devices' AquaLab water activity instrument is the industry standard for measuring water activity. The AquaLab is a powerful benchtop water activity instrument that is effective in determining the water activity of products post production. But what is happening during storage and shipping? If abuse-type conditions such as high humidity or high temperature occur during storage and/or shipping, product quality, safety, and shelf life may be altered.

Because shipping and storage conditions are often changing, it is difficult to monitor water activity and temperature with single spot tests. Consider a product that is tested and found to be acceptable, but is then exposed to abuse conditions and spoils several days later during storage. Since there are no test results that indicate that the batch has spoiled, the product is shipped to a customer, found to be spoiled, and immediately rejected with a note to not buy from that supplier again. If the test had been conducted after the exposure to abuse conditions, the product would have been deemed unacceptable and the problem avoided. However, spot testing did not and in most cases will not discover storage and shipping problems. A system that can log water activity (relative humidity) and temperature over time is needed to make it possible to know exactly when conditions became unsafe.

In response to the need to be able to log water activity over time, Decagon Devices, Inc. introduces the SafeStorage System. The SafeStorage System consists of a 5-channel data logging SafeStorage Monitor, which records water activity and temperature data from up to 5 SafeStorage probes. The probes are small and versatile sensors with 10 ft of cable that can be extended to 110 ft. The probes can be mounted anywhere to record water activity (relative humidity) and temperature. They can

be inserted into a package either over or in a product (resealing the hole with vacuum grease and packing tape), inside a storage warehouse to record humidity conditions, inside a shipping container to record conditions during shipment, or inside a grain bin to monitor storage conditions.

The SafeStorage Monitor will collect and store data from the probes at preset time interval (minutes, hours or days). Data is downloaded from the logger by either serial or radio connection to a computer and analyzed using the DataTrac software. The software presents water activity and temperature data in both table and graphic form. View preferences can be toggled between water activity and relative humidity, while temperatures can be viewed in either Celsius or Fahrenheit. The software also makes it possible to set up target zones for both water activity and temperature and view the zones graphically. The target zones are highlighted by different colors, making it easy to determine when conditions have become unsafe. The question may arise, "how can the SafeStorage System benefit me?" Consider the example of a manufacturer using water activity to maintain the flow properties of their powder product. Their standard testing procedure consists of randomly testing their products off the production line for water activity to make sure they meet specifications. The company becomes perplexed when they begin receiving complaints that their powder product is arriving at their customers facilities caked and clumped. Reference to water activity testing results conducted post-production indicates that the water activity of the powder should have been less than the critical value for caking. The changes to the product must have occurred during shipping or storage.

Now imagine that this company decides to utilize the SafeStorage System to monitor conditions during storage and shipping. Initially, they decide to use the system to determine if their warehouse is the source of the abuse conditions. Three of

the five probes from the SafeStorage System are inserted directly into packages with product. This is done by making a small slit in the package, inserting the probe, and then resealing the slit over the probe cable. The other two probes of the SafeStorage system are placed in the open air inside the warehouse to monitor environmental conditions. Then, the collected data is visualized using the DataTrac software and it is determined that the packaging being used by the company is not preventing moisture exchange between the product and the environment in the warehouse. A new and improved package is designed with better moisture barrier properties. The SafeStorage System is then used to test the effectiveness of the new design.

The company also realizes that they ship their product around the world in non-temperature controlled shipping containers. To determine if abuse conditions are occurring during shipping, they purchase an additional SafeStorage System and install the probes inside a shipping container both in packages with product and in the open air inside the shipping container. This data indicates that conditions inside the container are fluctuating, but the new package design (which resulted from earlier testing with another SafeStorage System) is keeping the product safe. The information provided by the SafeStorage System helps the company realize why they are having problems with their product, and where the abuse conditions are occurring. It also assists in verifying that the new package design has solved the problem and that it is not necessary to change their shipping methods (at considerable cost savings). By using both an AquaLab and a SafeStorage System to monitor their products, the company has created a complete water activity system that ensures a high quality and safe product.

Every company may not need a SafeStorage System for all of the situations described above, but chances are they can find a way to use the SafeStorage to their advantage. The capability of the SafeStorage system to assist in monitoring water activity or relative humidity is only limited by the imagination.