Understanding Detector Tube Shelf Life
by Ron Roberson

Each box of Sensidyne detector tubes comes with an expiration date stamped on the top of the box. This date indicates the last month that the tubes may be used for which the accuracy specification of +/- 25% of reading still applies. It also indicates the end of the warranty period. We get numerous questions based on those stamped dates. How are these dates determined? What happens to the tubes after that date? My tubes were refrigerated, are they still good? Let’s take a look at these questions and a few others as well.

Why post a shelf life in the first place? The shelf life of a given detector tube has a direct correlation to the relative stability of the chemicals used in that particular tube. The more stable the chemical, the longer the shelf life can be. As chemicals age and deteriorate inside the tube, the tube function will also deteriorate, and at some point, the tube will no longer attain its specified accuracy. Eventually, the tube will reach a point when it will no longer respond to the target gas at all. The shelf life is designed to assure that the aging tube is still operating correctly.

How is a shelf life determined? When a given detector tube (i.e., a given type of tube or a given part number) is produced at the factory, samples from the production lot are tested with challenge gases to determine the printed measuring scale that will be applied to that lot of tubes. Retained samples are then tested at intervals throughout the tube’s shelf life, to assure that a given lot will meet its posted expiration date. Life curves can be produced for each part number, and trends of a group of consecutive lots can be studied. The shelf life of a given type of tube is often modified based on experience with that part number through the life curves produced from this continued testing. The shelf life of a newly developed tube is often based on experience with existing tubes that use similar chemicals, and then assigned conservatively at first. The shelf life for that new part number is usually adjusted later, once the tube has established its own track record through lot testing.

So how does a tube react after the expiration date? As a box of tubes ages, and the chemicals deteriorate, the length of the stain will change for a given gas concentration. Different chemistries will act differently as they age. For example, a tube that uses an acid-base reaction will tend to read higher as it ages, because the chemical dies out at random. The target gas then has to travel farther into the tube to find reactive material, and you wind up with a stain that is longer and paler in color than was produced at the original factory calibration. A tube that uses an oxidizer in the tube’s pre-layer can do just the opposite. The oxidizer is normally the least stable chemical in the tube, and it dies out first. At some point there will not be enough oxidizer to react with the incoming target gas, and so the target gas will travel through the tube un-reacted. In this type of tube, the readings will become lower as the lot ages.

If I refrigerate my detector tubes, won’t they last longer? Generally speaking, detector tubes will stay fresher longer if refrigerated. Some tubes will require refrigerated storage to meet the posted shelf life, and are so labeled, but most tubes require only room temperature storage. Refrigerating a tube that requires only room temperature storage will retard the chemical deterioration and keep the tubes fresher. However, this does not change the expiration date, which is also the tube’s end-of-warranty date. It is also not possible to quantify the freshness without testing a sample of the tubes against a known standard gas. It is recommended that tubes are not used past the expiration date, even if refrigerated, without documented testing to prove that they are still working accurately.

One final note on refrigeration, refrigerated tubes can be damaged if stored too cold. The specification for storing detector tubes in a refrigerator is 5° to 10°C (40° to 50°F). Detector tubes should never be stored frozen, as that can cause the chemical to come loose. The end plugs that hold the chemical in place will tend to contract more than the glass does when frozen, and if frozen tubes are bumped around, the end plugs can move. Never store tubes frozen, and always allow refrigerated tubes to come up to ambient temperature before using them.

Detector tubes systems provide a great tool to the industrial hygienist and/or safety professional. Many detector tubes also find valuable use as process measurement tools in numerous industries. Understanding and properly observing the shelf life expiration date is critical for optimum accuracy and reliability of detector tube readings.