

# HANDLING LEL SENSOR POISONS

It is well known that certain chemicals inhibit or poison the catalytic bead in LEL (combustible) sensors, leading to partial or complete loss of sensitivity. Poisoning is defined as a permanent degradation, while inhibition is usually recoverable by exposure to clean air. For the best sensor performance, it is crucial for both instrument users and manufacturers to avoid operation of the devices in an environment containing poisons and inhibitors.

## HOW LEL SENSORS WORK

The RAE LEL sensor consists of a matched detector and compensator made from coils of platinum wire embedded within a catalytic bead. Oxidation of combustible gases and vapors releases heat, changing the resistance of one element with respect to the other, which is detected as an out-of-balance voltage in a bridge circuit. The output signal is used for the detection of combustible gases and vapors. The RAE Systems LEL sensor is one of the most poison-resistant sensors on the market, but special care to avoid exposure to poisons is required to assure long sensor life.

## LEL Sensor Poisoning

The most serious poisons are silicon compounds, such as silanes, silicones and silicates. Just a few parts per million (ppm) of such materials are sufficient to degrade the sensing performance. These compounds are used in a wide range of products, including lubricants, mold-release agents, polishes, adhesives, cosmetic and medicinal creams, silicone rubbers (including caulking and sealant compounds), and others.

Lead compounds, such as tetraethyl lead in gasoline, is a well-known poison which reduces LEL sensitivity, especially for combustibles with high ignition temperatures, like methane.

High concentrations of halogenated hydrocarbons are thermally decomposed to HCl on the catalytic bead, which can cause corrosion of the sensor and low signal readings. H<sub>2</sub>S and other reduced

sulfur compounds, such as carbon disulfide, dimethyl disulfide, and trimethyl disulfide, as well as phosphate esters, nitro compounds (e.g., nitromethane, nitroethane, and nitropropane), are oxidized to mineral acids that may be corrosive to the sensor. Hot organic acids (such as acetic acid), and direct exposure to acid gases (e.g., HCl, sulfuric acid vapors) can also corrode sensors. Chlorinated hydrocarbons are frequently found in solvents including degreasing and cleaning agents. Harmful chlorinated substances are also given off by overheating some polymers and plastics such as PVC insulated wire during soldering.

The forementioned materials are known to have a detrimental effect on the catalytic bead. Silicones are usually considered as one major poison source, and H<sub>2</sub>S as an inhibitor. However, most compounds fall into both categories to various degrees. Some compounds may chemically react near the catalytic bead at elevated temperature. This makes the poison mechanism more complicated.

## Operation Precautions

To keep the sensor operating for a longer time, special attention should be made to reduce exposure of the sensor or monitor to poisonous environments. Here are some tips:

- Follow the precautions below for Assembly and Service.
- Always use a recommended filter in front of the sensor, and change the filter weekly, or immediately after the exposure to a poison.
- Clean the pump and replace the tubing, filter, and gasket after a serious exposure to poisons.
- Reduce the exposure time of the sensor in poison surroundings, and turn the monitor off when not in use.
- Decrease the flow rate of gases over the sensor during operation in poison environments, or use a diffusion-type monitor instead.

### **Assembly and Service Precautions**

To avoid introducing poisons to the monitor:

- Do not use any molded plastic parts that have been manufactured using silicone mold release agents.
- Do not use silicone rubber, elastomer, or sealants for gaskets, potting or insulation. These materials are particularly hazardous during mixing and setting, when they give off substantial amounts of vapor. Avoid operating the monitor in areas where these compounds are mixed or are curing.
- Do not use polishes, cleaners or lubricants containing silicones in the area where the instruments are assembled, tested or stored. Most domestic furniture polishes contain silicones.
- Assemblers and service technicians should not use cosmetic or medicinal hand creams containing silicones.
- Silicone lubricants are common in valves and regulators used in gas-distribution systems. Never use these components with LEL sensors.
- Epoxy and adhesives must be poison-free. Avoid using self-stick labels on the monitor or any internal parts. Many adhesives used on labels contain silicones.
- Only use RAE Systems parts for replacement.

With these precautions, your RAE Systems combustible sensors will operate reliably in RAE Systems gas monitors. Follow the instructions in the operations manual for routine maintenance. Always test gas monitors before use.