

# Gas Detection Considerations when dealing with Moderate Risk Waste (MRW)

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# The issue...

- A recent rule requires that when flammable liquids are bulked at solid waste facilities **continuous monitoring and controls** must be taken such that “**...flammable or explosive gases do not exceed 10% the Lower Explosive Limit (LEL) in the area where the MRW (Moderate Risk Waste) is handled.**”
- Reference: From 173-350(6)(a)(xi) WAC

# Terminology – What does it mean?

- **LEL** Lower Explosive Limit – The lowest percent concentration of an atmosphere in O<sub>2</sub> that will create an explosion. Note that CH<sub>4</sub> = 5% but Hexane = 1.1% by volume.
- **UEL** Upper Explosive Limit – The highest percent concentration of an atmosphere in O<sub>2</sub> that will sustain an explosion. Note that CH<sub>4</sub> = 15% and Hexane = 7.5%.
- **PEL / TWA, STEL, IDLH:** Many chemical substances are **toxic** to humans. PEL/TWA = the limit of exposure over an 8 hour work day, STEL = Allowed exposure over 15 minutes and IDLH = Deadly within 15 minutes. Toxic chemicals are **NOT** measured by LEL meters. (Note: This is not the subject of this discussion.)

# Information?

**Where can I found out about the threat posed by a potential atmospheric condition or chemical?**

- **MSDS:** Material Safety Data Sheet
- **NIOSH** - National Institute of Occupational Safety and Health / A division of the Center for Disease Control.  
[www.niosh.com](http://www.niosh.com)
- **ACGIH** - American Congress of Governmental Industrial Hygienists. [www.acgih.org](http://www.acgih.org)
- **Occupational Safety and Health Administration** – A subsidiary of Labor and Industries. [www.osha.gov](http://www.osha.gov)
- **WISHA** – The Washington arm of OSHA.  
[www.lni.wa.gov/wisha](http://www.lni.wa.gov/wisha)
- **OR-OSHA** – The Oregon arm of OSHA.  
[www.orosha.org](http://www.orosha.org)

# What threat are we talking about?

- **Landfill operations** generally have a background of Methane (**CH<sub>4</sub>**) and Hydrogen Sulfide (**H<sub>2</sub>S**) from the breakdown of organic materials.
- **Bulking areas for MRW** store **long-chain hydrocarbons** and/or **Volatile Organic Compounds. (VOC's)**

(The focus of this discussion is on this latter grouping.)

# MRW – The risk changes with temperature!

- In a location in Oregon, I received calls from the owner of a fixed detection system that they... “were getting false alarms on their explosimeter!” I responded by taking an RKI Eagle <sup>TM</sup> portable to perform a secondary check. As soon as I walked to the back corner of the bulking station the Eagle went into alarm @ 10% of the LEL. Their instrument was reading correctly and they did have a potential hazard brewing.
- **What’s up?** The Willamette Valley is usually moderate in temperature. However, the temperature had ranged above 100 degrees Fahrenheit for a 4 day period. The VOC’s, though heavy, were “flashing off” under the heat and creating a hazardous environment.

# Common Sensor Technology and Function

- **Catalytic Bead Sensors:** Operate on the principle that a wire heated by catalyzing a VOC present resists the flow of electrons more than a reference voltage. These sensors are very reliable if: a. They are present in a minimum of 5% O<sub>2</sub>. b. They are not in the presence of poisoning agents / Silicon c. They are calibrated on a regular (90 day) basis and (d.) They are replaced every 3 – 3.5 years.

# Common Sensor Technology, Cont'd...

- **MOS: Metal Oxide Sensors** – Operate on the principle that a metallic switch being oxide coated on one side but not on the other deflects through the heat of reaction more on one side than the other. Concentrations of VOC's can be related to the amount of deflection in the switch. These sensors have the advantage of low-cost of purchase and operation. However, they have the following pitfalls. A. They respond to “general” class of hydrocarbons. IE: H<sub>2</sub> responds the same as CO! B. Their detection is limited to the higher ppm ranges.

# Common Sensor Technology Cont'd...

- **Infrared Technology** – Built on the principle that long wave length light (**IR**) is absorbed by combustibles, CO<sub>2</sub>, etc...The amount of absorption = concentration of the gas. This is a rock solid form of detection where you have: a. Low or zero O<sub>2</sub> and b. The pitfall of IR technology is that it is limited with regard to target gases and more expensive initially.

# Common Sensor Technology Cont'd...

- **The ID's:** Photo and Flame Ionization Devices work on the principle of kicking the electrons up with flame or light energy. When electrons fall back down, they emit energy = concentration of the gas. The ID's can measure VOC's with accuracy into the ppb (parts per billion) range. Their pitfall is that the technology is more costly to purchase and maintain.

# Fixed Systems Considerations

## Sensor Location RKI

- Sensors must not be placed at greater than a 50' – 0" radius within the measured area.
- Heavier than air products require sensors or pickup close to the floor.
- Lighter than air products require sensors or pickup very close to the ceiling of the space.
- Areas of high humidity or wash down will require sample draw instrumentation.
- Areas of extreme low or high temperature will require sample draw instrumentation.
- Always consider placement of the sensor with regard to set up and future calibration. Can you reach it easily?

# Solutions – RKI Fixed Options

## Stand Alone Units

- **PS2:** Generalized hydrocarbon response **MOS technology**. Offers a low cost alternative to meet MRW requirements.
- \$435.00 offers a go-no go stand alone unit that can be plugged in to 115 VAC and has operational set points of 10%LEL (LOW) and 50% (HIGH) to trip relays powering fans, opening vents and even triggering 911 warning calls.
- Although MOS technology is stable, it still requires calibration on start up and regular intervals (90 days) thereafter.
- Remember: MOS technology is non-specific! This may respond to CO the same as it does to H<sub>2</sub>.

# Stand Alone Units, Cont'd...

- **M2 Series:** \$850.00 features real-time display, catalytic bead sensor specificity, Relays to drive response (fans, vents, alarms, or alarm calls), Non-intrusive (easy) calibration.
- **M2** sends out 4 – 20mA signal that can go to pc based operating systems or to a standard RKI controller for output in your control room.
- **M2** always requires calibration at the time of set up and periodically during it's operation.

# Controller, Sensor and Transmitter Systems by RKI

- **Controllers** interpret the signal from a sensor and give you real time display of the concentration of a gas in question. They have relays to drive strobe lights and warning horns as well as turn on exhaust fans and dial up a warning
- **Sensors** can be connected directly to controllers in cases where the detection is less than 35' away.
- **Transmitters** amplify the signal and send the 4 – 20 mA signal to the controller over long distances.

# Controller options...RKI

- RKI offers controllers to suit all demands. You may order controllers to handle 1,2, 4 or up to 8 sensors. Furthermore, controllers can be grouped together to monitor/control the activity of large groups of sensors.
- **Beacon 110** = \$ 695.00
- **Beacon 200** = \$1,250.00
- **Beacon 400** = \$1,550.00
- **Beacon 800** = \$1,995.00

# Sensor Options **RKI**

- Beacon 110, 200 and 400 can accept direct connect sensors up to 35' away from the transmitter.

## Direct Connect Sensors

- LEL with J Box                      \$350.00  
Beacon 110, 200, 410 will accept the 4-20 mA output of the S-Series as well.

## S-Series Sensor/Transmitters

- LEL with J Box                      \$500.00  
( The **S-Series** can operate without a controller **IF** it's 4 - 20 mA signal drives a pc based control and monitoring system!)
- **All sensors must be calibrated upon start up and at regular intervals thereafter.**

# Portable Gas Detection by **RKI**

- **Portables** are good for spot checking areas of concentration around the MRW facility. Portables are also excellent as back up to your fixed system to check it's function and for other confined space maintenance work.
- **Single Gas LEL Detection:**
- Alkaline = \$420.00 / NiCAD = \$475.00
- **4 Gas Detectors: LEL, O2, H2S, CO**
- Diffusion: \$795.00 Sample Draw: \$1,325.00
- **Up to 6 Gas Detection, Super Toxics, etc...**  
Call for pricing and model for your specific need!

When purchasing portables always budget for calibration supplies, necessary filters, pumps and batteries...

# Conclusion: You can do this...but do it right!

- Not all gases have the same LEL. Longer chain hydrocarbons and hydrogen have much lower % LEL. Temperature variations can cause VOC's to "flash off" that ordinarily would not be a problem.
- **RKI** Fixed real-time instrumentation is available that can detect accurately LEL and a host of other atmospheres. Know your hazard and detect it!
- **RKI** portable instrumentation should be used to check for hot spots and as back up to your fixed systems.
- Fixed systems are only as reliable as those that install and set them up. Choose your contractor carefully and oversee it's installation!
- Fixed systems must take into consideration sensor locations with regard to temperature, humidity, gas in question and future calibration / maintenance efforts. **Consult RKI!**
- Persons caring for fixed and portables should be be trained in changing pumps, filters and sensors as well as calibrate the instruments. Always budget for maintenance and calibration.