

# Webinar Audio Recording

- ▶ To play the audio recording:
  - ▶ Go to:
    - ▶ <http://www2.teleconferencingcenter.com/moderator/presentation/Playback?id=984f9c7c-6f2b-4395-9390-b9b60c3e052d.rpm>
  - ▶ Enter your name and email
  - ▶ Select whether to use Windows Media Player or Real Player.  
To play the recording, you must have one of these installed on your computer. The Real Player tends to work better.
    - ▶ <http://windows.microsoft.com/en-US/windows/downloads/windows-media-player>
    - ▶ <http://www.real.com/>
- ▶ The audio recording for this webinar starts at slide #21.





THE **GREENCHILL** PARTNERSHIP



# *Leak Detection: Creating a Program that Works*

June 7, 2012



# Welcome / Webinar Etiquette

- ▶ Audio is being recorded
- ▶ Slides and audio will be available on GreenChill website, under “Events and Webinars”: [www.epa.gov/greenchill](http://www.epa.gov/greenchill)
- ▶ Phones are muted (#6 to unmute)



# Q & A

- ▶ Q&A session after presentation
- ▶ Submit your questions using CHAT at anytime; we'll go through them during Q&A
  - ▶ If you'd like to remain anonymous, send your question by CHAT to Keilly Witman instead of to all participants
- ▶ Raise your hand during Q&A (hand button is at top of screen)



# Please Note!

- ▶ GreenChill and EPA do not endorse products or companies.
- ▶ The information in the webinar is from the presenters. It is not verified by GreenChill or EPA.
- ▶ The opinions of the presenters are their own, and they do not represent GreenChill or EPA.
- ▶ We are not webinar-ing experts.



**Today's speakers.....**



# Ted Gartland – E. Gartland and Associates

Ted Gartland

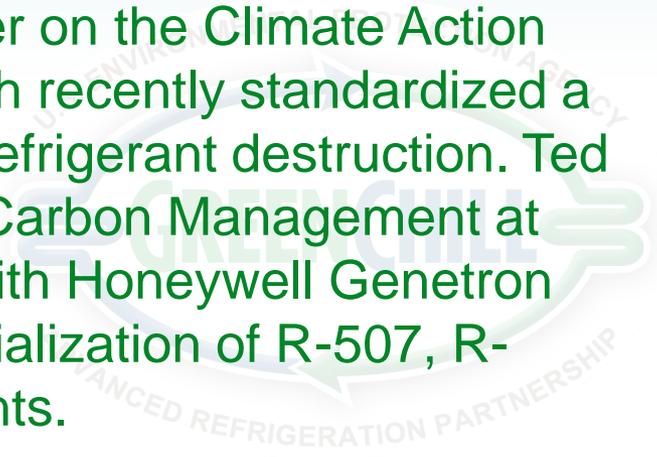
E. Gartland and Associates

Office: 585-624-9648

Email: [ted.gartland@egartland.com](mailto:ted.gartland@egartland.com)



**Ted Gartland** is the owner of E. Gartland Associates, a refrigeration and environmental consulting firm. Ted is an adviser on the Climate Action Reserve ODS destruction working group, which recently standardized a methodology around carbon offset credits for refrigerant destruction. Ted was formerly the Director of Refrigerants and Carbon Management at Verisae. Previously, he spent fourteen years with Honeywell Genetron Refrigerants where he worked in the commercialization of R-507, R-404A, R-410A and many HFC based refrigerants.



# Matt Thiel – Bacharach

Matt Thiel

Business Unit Manager – Gas Detection

Bacharach

Office: 724-334-5066

Email: [MattT@MyBacharach.com](mailto:MattT@MyBacharach.com)



**Matt Thiel** is the Business Unit Manager for Bacharach's gas detection products. He has fifteen years of gas/leak detection experience, with the last two years focusing primarily on refrigerant leak detection technologies and applications.



# Jim Mowery – Bacharach

Jim Mowery

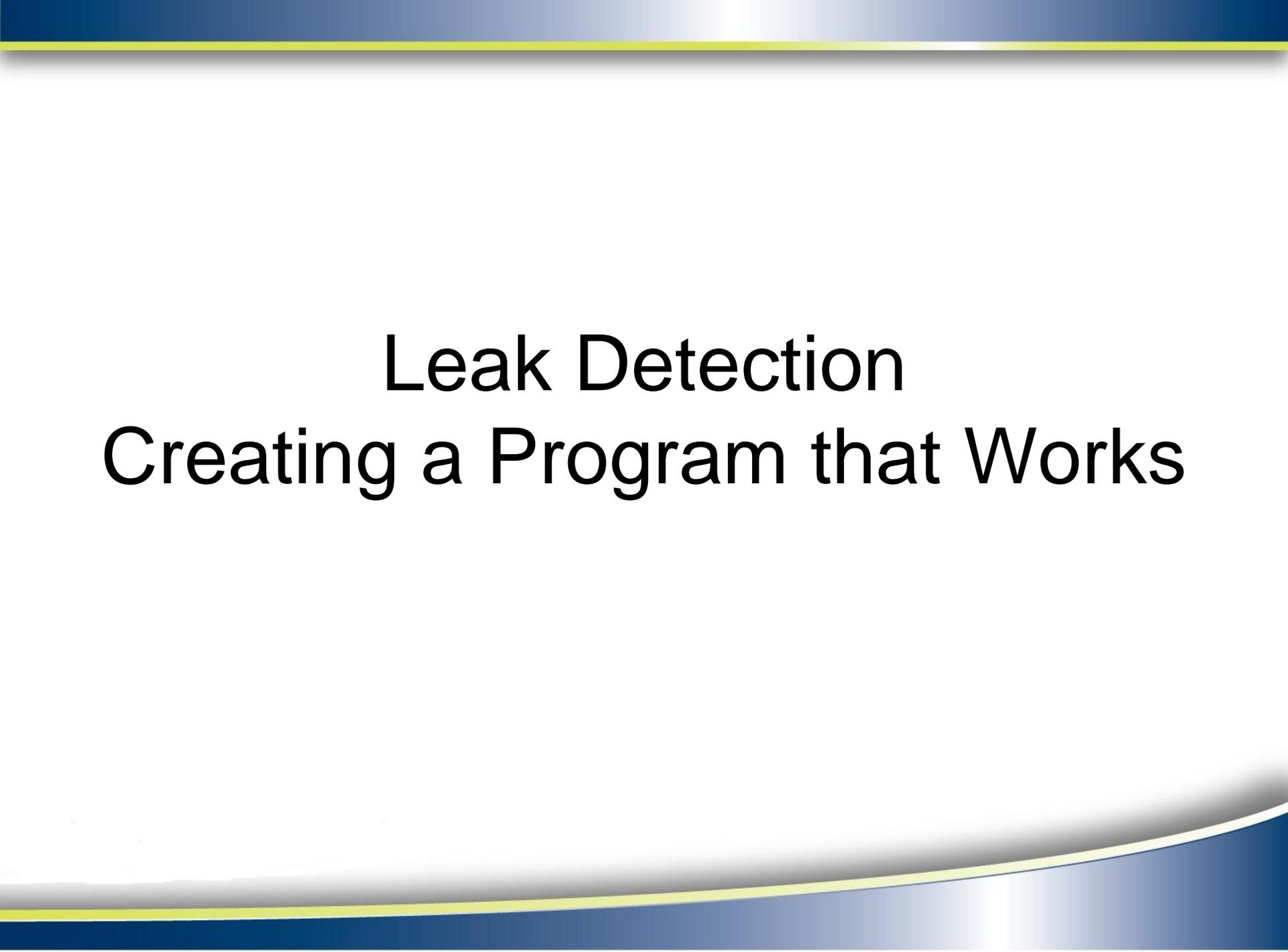
Bacharach, Product Specialist

Office: 410-703-4238

Email: [jimmowery@mybacharach.com](mailto:jimmowery@mybacharach.com)



**Jim Mowery** has worked at Bacharach for twelve years, the last three in the refrigerant monitor division as a sales and training product specialist. He is licensed to handle all types of refrigerant gasses and is experienced in both sales and service of heating and air conditioning instruments. Jim currently holds a patent on a heating control system for heat pumps. He is currently focusing on sales and training for fixed monitoring systems. Jim holds a degree in business management and has additional education credits from James Madison University and the American Management Association.



# Leak Detection

## Creating a Program that Works

# Agenda

- Why Monitor?
- Sensing Technologies
- Continuous vs. Manual
- Selecting the Right Product
- Cost of Leaks

# What are the benefits of a Refrigerant Monitor?

- Reduce energy consumption – **SAVE \$\$\$**
- Reduce emissions of ozone depleting agents – Be **GREEN**
- Reduce the amount of refrigerant being used – **SAVE \$\$\$**
- Being code compliant
  - ASHRAE 15, ASHRAE 147, California Sub article 5.1
- To protect people (refrigerants are oxygen displacing agents)
- To protect products & equipment
  - Food products (meat, produce, dairy)
  - Chillers, RAC units, and walk-in boxes

# Industry Trends

- California Sub article 5.1/ F-Gas
  - Mandatory monitoring / leak checking
- Refrigerant Management Programs
  - Lower detection limits (10 ppm)

# Myth or Reality?

80% of leaks occur in the engine (Rack) room

*Most monitoring takes place in the engine rooms.*

*Most technology cannot accurately detect and locate small leaks.*

*What if we could find the small leaks?*

# Reality

***Many leaks occur in display sales area, freezers, coffin cases and Dairy coolers.***



# Sensing Technologies



# Metal Oxide (MOS) Sensors

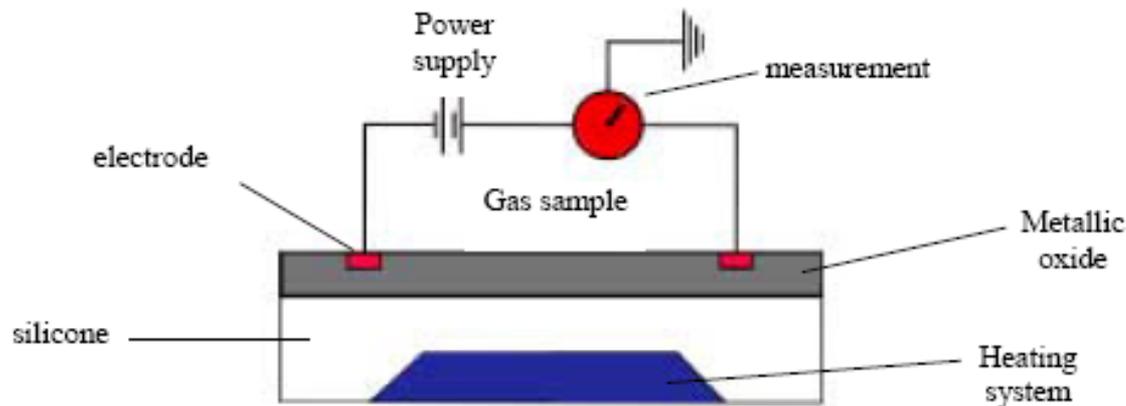
(AKA – Solid State, Heated Diode)

- Detect toxic, combustible & refrigerant gases
- Respond to many compounds, including H<sub>2</sub>O and temperature changes
- Not very accurate
- Require calibrations
- Low cost
- Long life span (5-7 years)



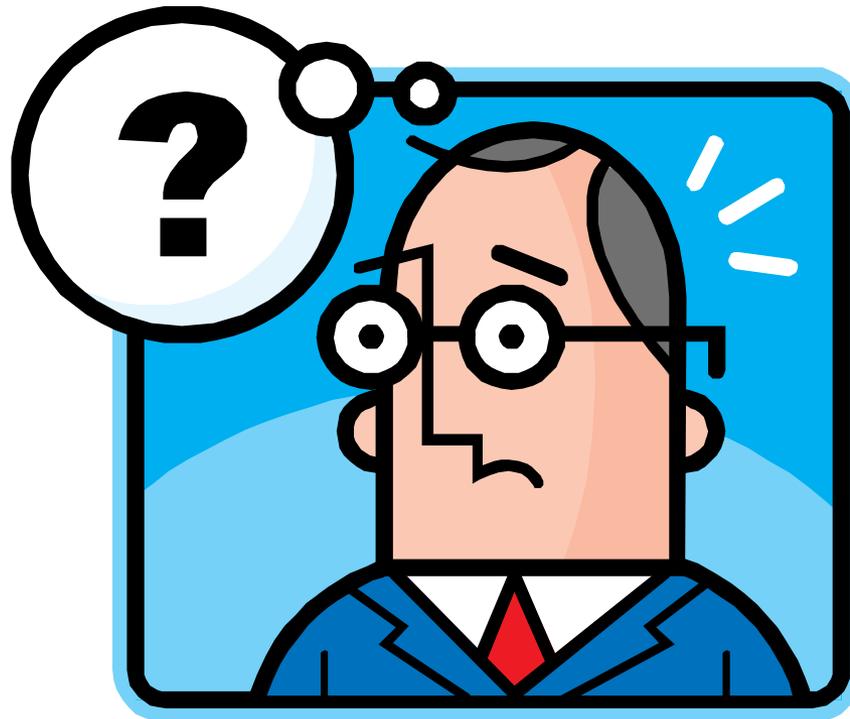
# Metal Oxide (MOS) Sensors Detection Principal

A fine metallic oxide film is deposited on a silicon wafer (see. illustration below). The absorption of the sample at the surface of the metal oxide is followed by a catalytic oxidation and modifies the electric resistance of the oxide. This value is linked to the gas concentration.



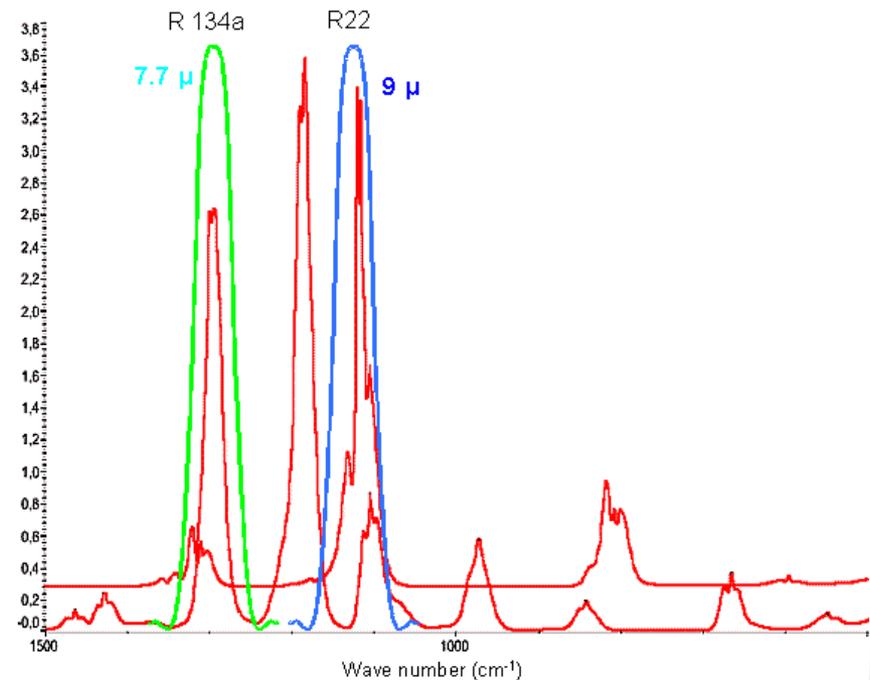
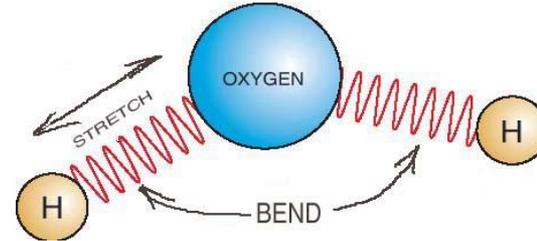
*Semi-conductor sensor*

So how does Infrared detection differ?

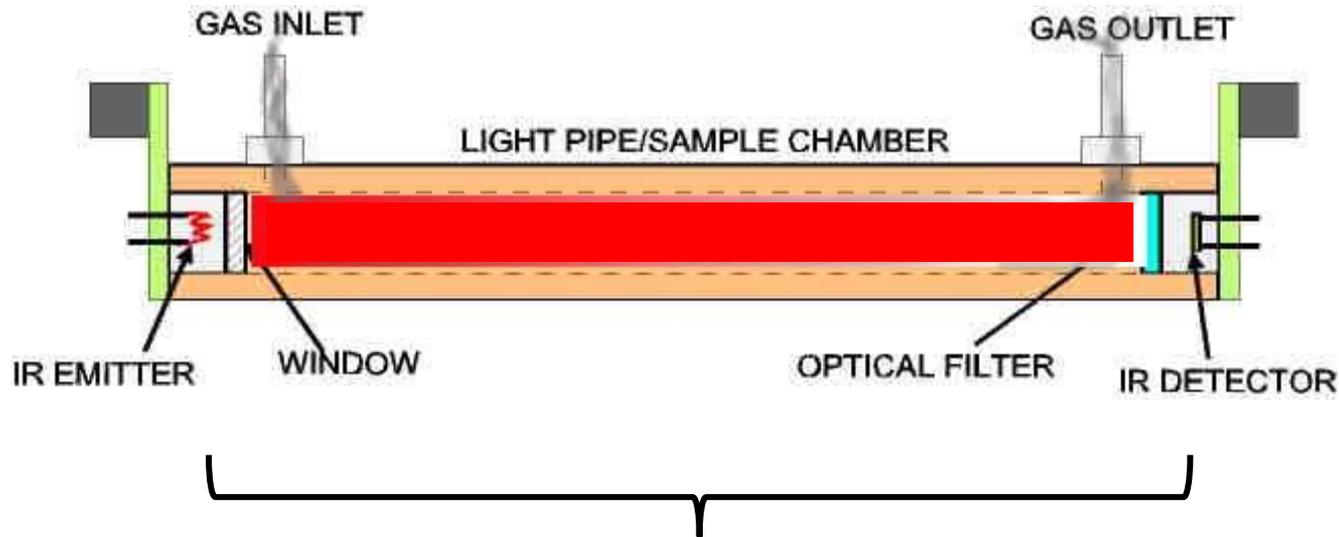


# Technical Background

- Infrared gas detection is a well established technology that has been practiced for more than 60 years.
- It is based on the principle that any gas molecule composed of two or more dissimilar atoms will absorb infrared light in a manner unique to that specific molecule.
- The unique pattern of absorption, dictated by the molecular structure, is called an absorption spectrum, and represents a fingerprint for a specific molecule.



# What does this mean?



Path Length Determines Minimal Detectable Limit

~ 7 inches = 25 ppm

~10 inches = 1 ppm

# Infrared Gas Sensing

- Advantages
  - Able to Self-test / calibrate
  - Fast Response Times
  - Very selective, few cross interfering gases
  - 1 ppm sensitivity
  - Low level accuracy
- Disadvantages
  - Sensitive to H<sub>2</sub>O
  - Maintenance required for dust and water

# Leak Detection Excuse Selection Chart

Continuous monitors don't work

I don't have time to manually inspect every line

You can't find small leaks

Small leaks are not worth finding

Putting detectors on the store floor doesn't work

You can't find leaks in cases/reach-ins

You can't find leaks outdoors

All leaks occur in the RAC rooms

My continuous monitor never alarms

My continuous monitor alarms but I cannot find a leak

Leak detection is too expensive

I'm manually checking, I don't need a continuous monitor

I have continuous monitor, I don't need a good hand held detector

# How do I Monitor Leaks?

- Portable leak detector
- Continuous monitor



Create a Program that Works  
for You!

# Compliance vs. Management

- Compliance Monitoring:
    - Meets local regulator requirements
    - Looking for larger leaks
  - Refrigerant Management:
    - Find leaks sooner
    - Locate smaller leaks
- 
- Semiconductor Detectors
- Infrared Analyzers
- The diagram uses two large right-facing curly braces to group the items. The top brace groups 'Compliance Monitoring' and its two sub-points, with 'Semiconductor Detectors' positioned to its right. The bottom brace groups 'Refrigerant Management' and its two sub-points, with 'Infrared Analyzers' positioned to its right.

# Selecting the Right Continuous Monitor Product

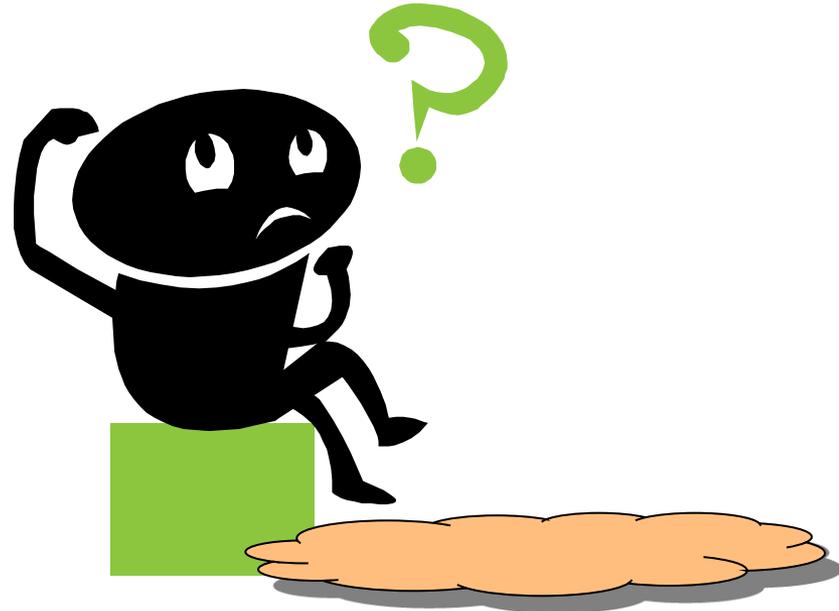
	Semiconductor	Diffusion Infrared	Infrared Sampling System
<b>Minimum Detection Limit</b>	50 ppm	15 ppm	1 ppm
<b>Cost Per Point</b>	\$400.00	\$1000.00	\$380 (16) - \$1250 (4)
<b>Installation</b>	Wiring	Wiring	Tubing

# Selecting the Right Portable Detector / Analyzer

	Semiconductor	Infrared Detector	Infrared Analyzer
<b>Minimum Detection Limit</b>	50 ppm	25 ppm	1 ppm
<b>Cost</b>	\$300.00	\$500.00	\$3000
<b>Indications</b>	Beeping	Beeping	Actual ppm readings
<b>False responses</b>	Temp/humidity	Change in background	None

# Where do I Monitor?

- You cannot monitor everywhere
- Monitor high probability areas
  - Compressor room
  - Walk in freezers
  - Cases / aisles
- Freon and CO<sub>2</sub> are heavier than air – tend to fall
  - Pick up locations should be close to ground for Freon
  - Pick up locations should be higher for CO<sub>2</sub> (as it disperses)



# Where do I Monitor – Compressor RAC?

- 2 pick-up points per RAC
    - **NOT** 2 per Mechanical room!
  - Multiple refrigerants, have multiple pick up points!
  - Can use a splitter kit
- 😊 Best Practice Tip:  
Mount A/V alarm  
outside mechanical  
room door



# Checking the refrigeration racks outside the wind does not affect the analyzer



# Where do I Monitor – Coolers/Freezers?

- Can monitor inside or outside for leaks.



Inside cooler under lines



Outside cooler door

- 😊 Best Practice Tip: Don't mount inside cooler next to door – will get frost build-up!
- 😊 Best Practice Tip: For CO2, mount pickup point at 4-6 feet

# Where do I Monitor – Cases?

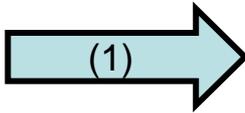


- Monitor inside or outside cases for leaks.
- In kick rails
- On Top of cases
- At each end
- Behind and in between two aisle cases

😊 Best Practice Tip: Try to maximize coverage area

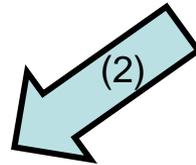


2 PPM



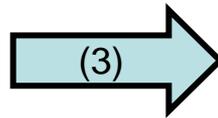
PPM reading increasing on Infrared Analyzer

17,672 PPM



Bubbles not finding it

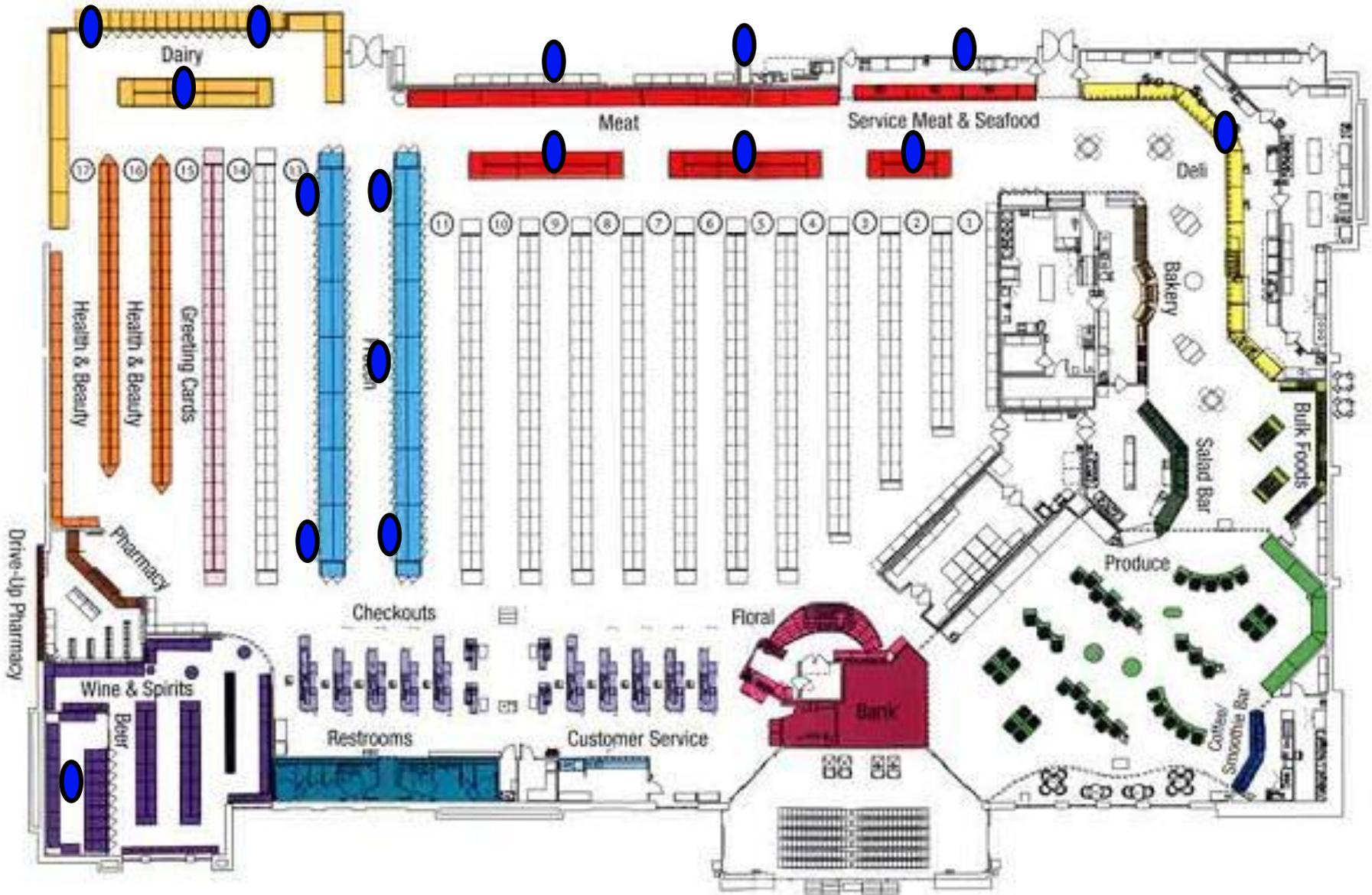
PPM reading increasing on Infrared Analyzer



Conclusion: Bad braze joint on the evaporator



# Where do I Monitor – Cases / Aisles?



# Best Practice Tips

- Utilize both handheld and continuous monitors
  - Continuous gets you to the area
  - Hand held pin points the leak
- Maintain your instruments (change filters)
- Test your equipment
- Set alarm thresholds appropriately
  - A must if you are using splitter kits/spurs
- React to alarms
  - Early detection saves the environment and money too

# Costs of leaks

Leak rate in pounds per month	Refrigerant type	Cost per pound	Cost of Leak per month		Number of months to cover continuous monitor Purchase	Number of months to cover Portable Analyzer Purchase
50	R22	\$12.00	\$600.00		11.0	6.2
100	R22	\$12.00	\$1,200.00		5.5	3.1
200	R22	\$12.00	\$2,400.00		2.8	1.5
250	R22	\$12.00	\$3,000.00		2.2	1.2
500	R22	\$12.00	\$6,000.00		1.1	0.6
50	R404a/R407a	\$8.00	\$400.00		16.5	9.3
100	R404a/R407a	\$8.00	\$800.00		8.3	4.6
200	R404a/R407a	\$8.00	\$1,600.00		4.1	2.3
250	R404a/R407a	\$8.00	\$2,000.00		3.3	1.9
500	R404a/R407a	\$8.00	\$4,000.00		1.7	0.9
			Infrared Continuous Monitor	\$6,600		
			Portable Infrared Analyzer	\$3,700		

# Real World Case Study

## Leak savings calculator

Case Study	Leak rate in pounds per month	Refrigerant type	Cost per pound	Cost of Leak per month		Number of months to cover continuous monitor Purchase	Number of months to cover Portable Analyzer Purchase
Location 1	695	R22	\$12.00	\$8,340.00		0.8	0.4
Location 2	48	R404a	\$8.00	\$384.00		17.2	9.6
Location 3	100	R404a	\$8.00	\$800.00		8.3	4.6
Location 4	200	R407a	\$8.00	\$1,600.00		4.1	2.3
Location 5	400	R22	\$12.00	\$4,800.00		1.4	0.8
Location 6	150	R404a	\$8.00	\$1,200.00		5.5	3.1

Infrared Continuous Monitor

\$6,600

Portable Infrared Analyzer

\$3,700

Thank you