# NEW HAMPSHIRE FIRE ACADEMY

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# INTRODUCTION TO TECHNICAL RESCUE SKILLS
# AIR MONITORING

## INSTRUCTOR GUIDE

February, 2009

## Introduction To Technical Rescue Skills – Air Monitoring
## Instructor Guide

### PREPARATION

Motivation: This course of study has been prepared to provide the student with the basic skills necessary to safely conduct air monitoring for possible hazardous environment as may be encountered in rescue situations. It is one of a sequence of courses within the Introduction to Technical Rescue Skills Program needed to participate in advanced technical rescue programs.

Prerequisites: Certified Fire Fighter I

### MATERIAL

Equipment: Power point projector, laptop and screen to accommodate presentation, easel pad with markers

Air monitoring equipment and supplies listed on page 28 in this manual.

### PERSONNEL

Primary Instructor: One (1) Primary Instructor and two (2) Assistant Instructors knowledgeable in air monitoring skills to conduct the classroom (cognitive) portion and the skills (Psychomotor) portion of the program.

**RECOMMENDED TIME TO COMPLETE TRAINING:** Four (4) hours to conduct the classroom portion and two (2) hours for the skills portion

## OBJECTIVES

## TERMINAL OBJECTIVE

- Upon completion of **Introduction To Technical Rescue Skills – Air Monitoring**, The student, given the proper equipment, shall safely demonstrate monitoring atmospheres for oxygen level, combustibility and toxicity.

## COGNITIVE OBJECTIVES

At the completion of this course the student will be able to:

- Utilizing the Risk based response, Identify 3 specific hazard areas.
- Identify protection level of Structural FF gear and SCBA as it relates to Hazardous Atmospheres
- Identify specific area of operation for utilization of air monitoring devices
- Describe how catalytic filament detectors operate and sample flammable/combustible gases.
- Describe how electro-chemical sensors operate and sample gases
- Describe flammable range
- Utilizing correction factors, convert meter readings to actual readings
- Identify levels of response and evacuation levels of gas percentages
- Describe Volatile organic compounds
- Define LEL, IDLH, TWA, STEL
- Describe how photo ionization detectors sample and analyze gases
- Describe how colorimetric tube samples gases
- Given an Unknown Material Identify/Classify by Hazard
- Given a meter reading, convert from percentages of gas to parts per million

## PSYCHOMOTOR OBJECTIVES

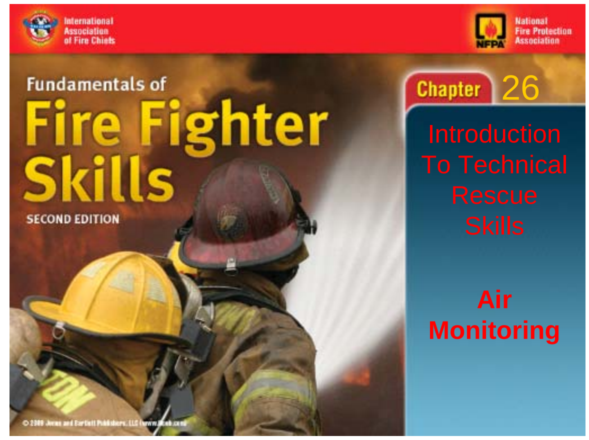
At the completion of this course the student will be able to:

- Operate Four Gas Meter
- Use and Read pH Indicator and/or Meter
- Operate a PID meter

# Introduction to Technical Rescue Skills-Air Monitoring

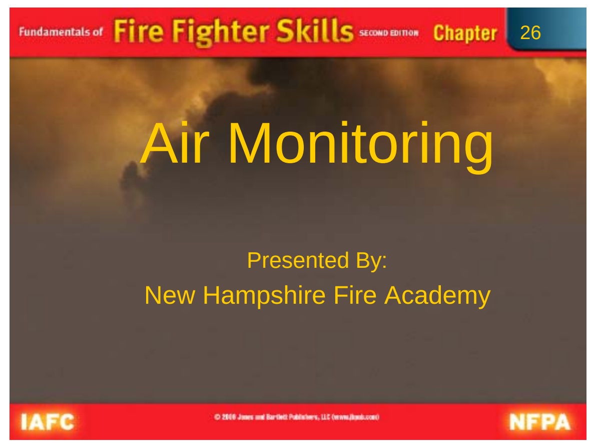
## I) Introduction

A) This course of study has been prepared to provide the student with the basic skills necessary to safely conduct air monitoring for possible hazardous environment as may be encountered rescue situations. It is one of a sequence of courses within the Introduction to Technical Rescue Skills Program needed to participate in advanced technical rescue programs.




II) Presented By:

A) New Hampshire Fire Academy




## III) Standards & Guidelines

A) NFPA 472 – Professional Competence of Responders to Hazardous Materials Incidents

B) NFPA 1006 – Rescue Technician Professional Competence

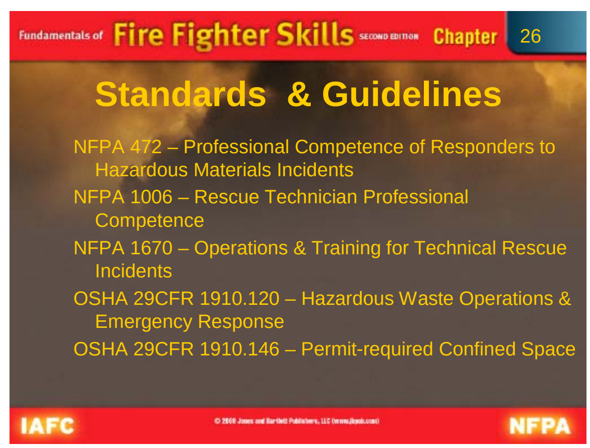
C) NFPA 1670 – Operations & Training for Technical Rescue Incidents

D) OSHA 29CFR 1910.120 – Hazardous Waste Operations & Emergency Response

E) OSHA 29CFR 1910.146 – Permit-required Confined Space

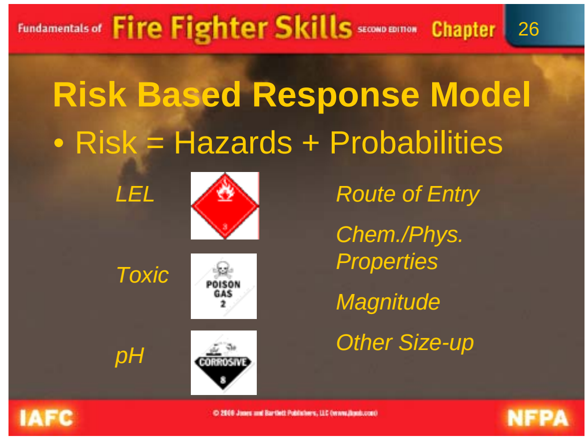
**Instructor Note:** Reinforce the need for air monitoring as required by the above standards.

Each standard identifies the need.



**IV) Risk Based Response Model**

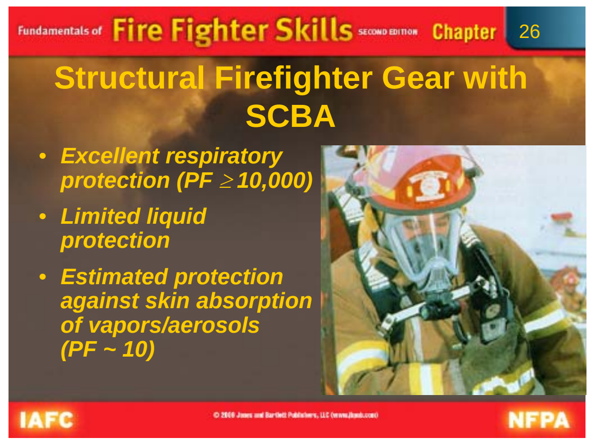
- A) Risk = Hazards + Probabilities
  - 1) LEL
  - 2) Toxicity
  - 3) pH
  - 4) Routes Of Entry
  - 5) Chemical And Physical Properties
  - 6) Magnitude
  - 7) Other – size-Up




**Instructor Note:** Assessment of risk by first identifying the hazard then assessing probabilities allows us to perform vital functions that may limit magnitude of incidents and save viable patients.

**V) Structural Firefighter Gear with SCBA**

- A) Excellent respiratory protection (PF □10,000)
- B) Limited liquid protection
- C) Estimated protection against skin absorption of vapors/aerosols (PF ~ 10)

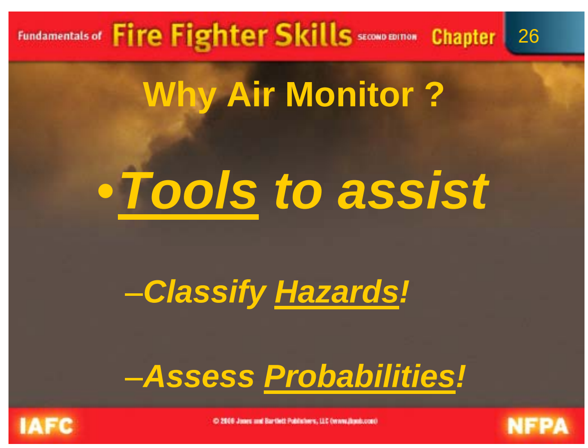



**Instructor Note:** Structural fire fighting gear is used as first response protection. Initial responders may have fire fighting gear but no chemical protective clothing. A response can be affected or product controlled using structural fire fighting gear if the limitations are known and hazards are assessed.

Time – Distance – Shielding Concept

**VI) Why Air Monitor?**

- A) Tools to assist
  - 1) Classify Hazards!
  - 2) Assess Probabilities!




**Instructor Note:** Utilization of measurement devices aids us to identify the hazard classification. With assessment of probabilities, control measures can be taken if hazards are identified.

VII) **Where to Air Monitor ?**

A) HazMat
   1) Perimeter Establishment & Maintenance
   2) Leak Detection
   3) Selection of PPE

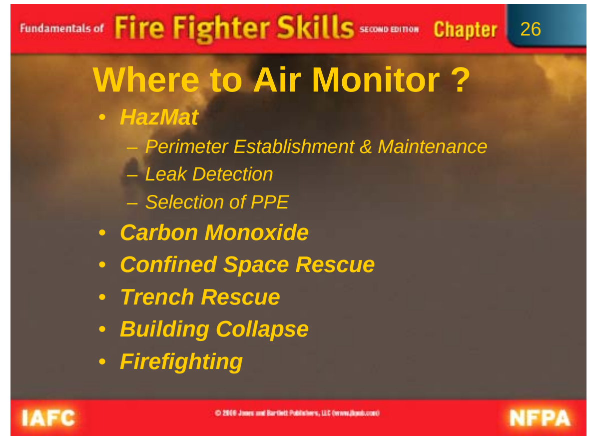
B) Carbon Monoxide

C) Confined Space Rescue

D) Trench Rescue

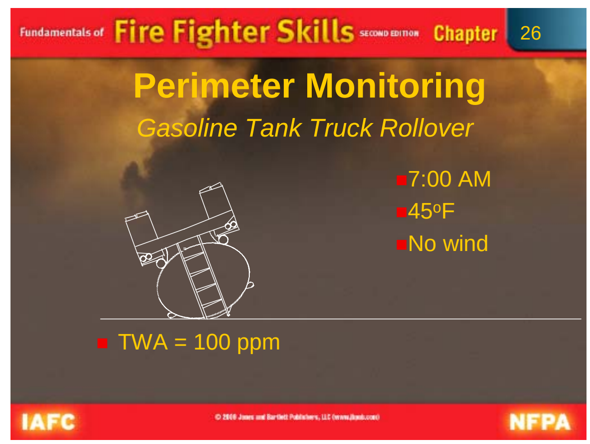
E) Building Collapse

F) Firefighting




VIII) **Perimeter Monitoring**

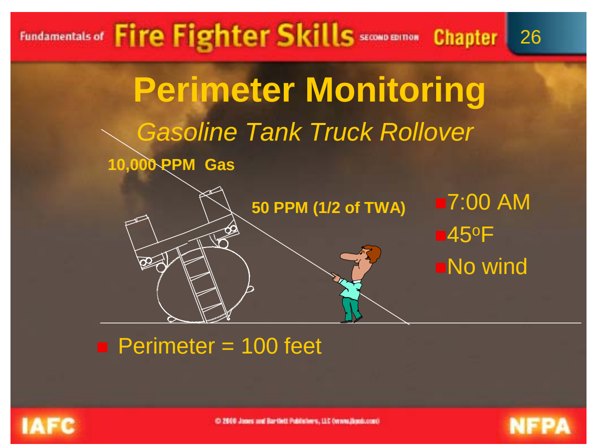
A) Gasoline Tank Truck Rollover
   1) Time 07:00 hrs.
   2) Temperature 45 Deg F.
   3) Wind, Calm
   4) The Time Weighted Average, TWA for Gasoline is 100 ppm.




IX) **Perimeter Monitoring**

A) Gasoline Tank Truck Rollover
   1) Time 07:00 hrs.
   2) Temperature 45 Deg F.
   3) Wind, Calm
   4) Monitoring reveals 50 ppm, ½ Of the TWA

B) Perimeter = 100 ft.



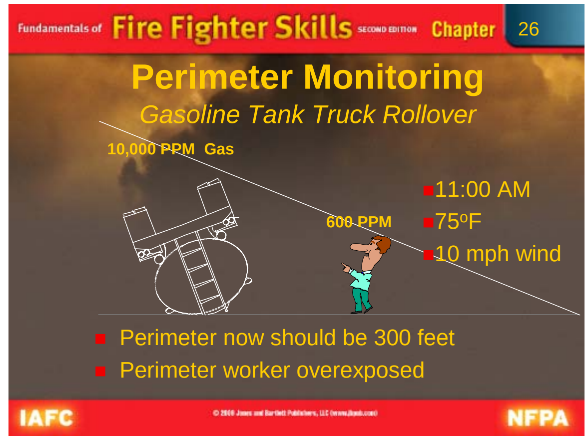
**X) Perimeter Monitoring**

A) Gasoline Tank Truck Rollover
   1) Time 1:00 hrs.
   2) Temperature 75 Deg F.
   3) Wind, 10 mph
   4) Monitoring reveals 600 ppm

B) Perimeter Should Be 300 ft.

C) Perimeter Worker Overexposed

**Instructor Note:** Continuous monitoring of hazard zone is necessary to ensure safety of personnel.

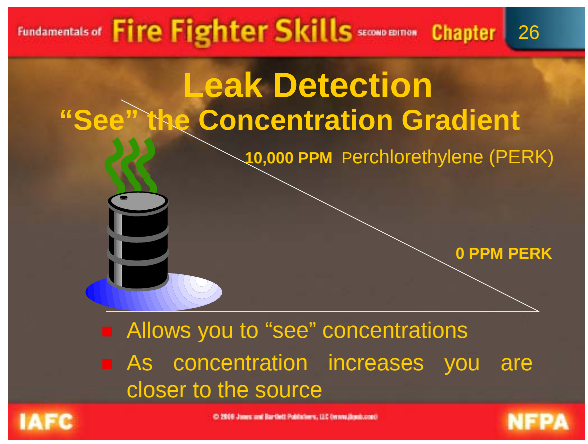



**XI) Leak Detection**

A) "See" the Concentration Gradient
   1) 10,000 ppm, Perchlorethylene

B) Allows You To "See" The concentration

C) As Concentration Increases, You Are Closer To The Source

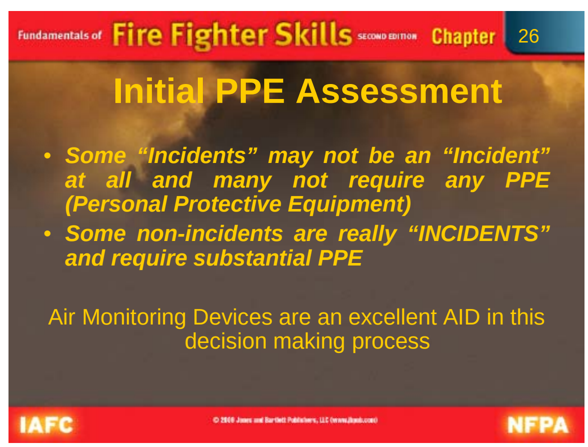



**XII) Initial PPE Assessment**

A) Some "Incidents" May Not Be An "Incident" At All And Many Not Require Any PPE (Personal Protective Equipment)

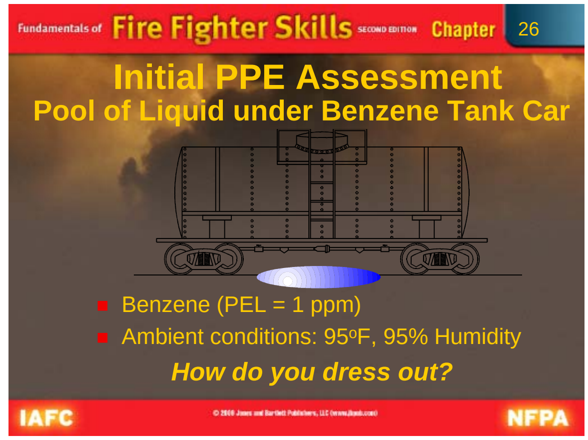
B) Some Non-Incidents Are Really "INCIDENTS" And Require Substantial PPE

C) Air Monitoring Devices Are An Excellent AID In This Decision Making Process



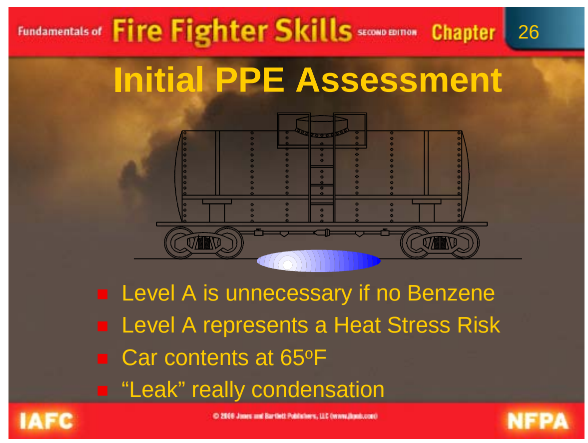
## XIII) Initial PPE Assessment

A) Pool of Liquid under Benzene Tank Car
   1) Benzene Permissible Exposure Limit, PEL, Is 1 ppm.
   2) Ambient Conditions:  95 Deg. F., 95% Humidity
   3) How Do You Dress Out?



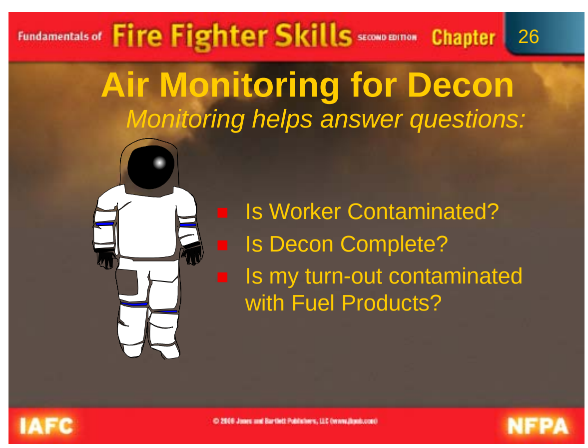

## XIV) Initial PPE Assessment

A) Level A Is Unnecessary If No Benzene
B) Level A Represents A Heat Stress Risk
C) Car Contents At 65 Deg. F.
D) The "Leak" Is Actually Condensation.



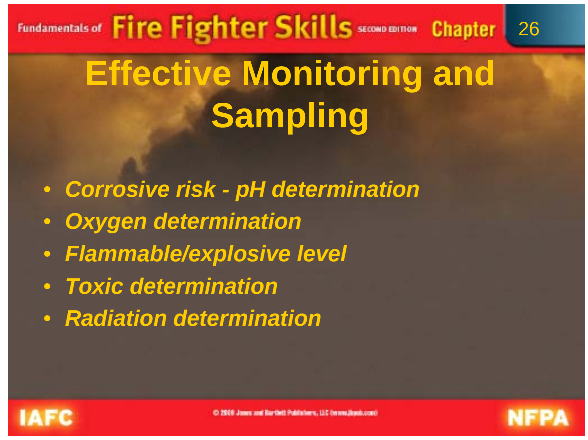

## XV) Air Monitoring for Decon

A) Monitoring Helps Answer Questions Such As:
   1) Is The Worker Contaminated?
   2) Is Decon Complete?
   3) Is My Turn-Out Contaminated With Fuel Products?



XVI) **Effective Monitoring and Sampling**

A) Corrosive Risk - pH Determination
B) Oxygen Determination
C) Flammable/Explosive Level
D) Toxic Determination
E) Radiation Determination

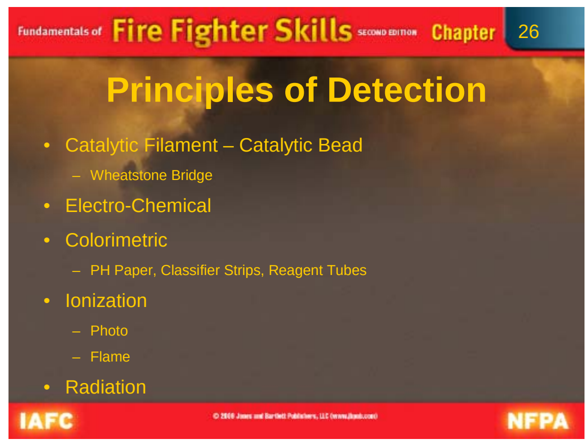



**Instructor Note:** Proper measurement order is key!

- Establish no corrosive hazard so meters are not damaged
- Establish normal oxygen in order for proper LEL readings.
- Radiation monitoring performed simultaneously to all other monitoring.

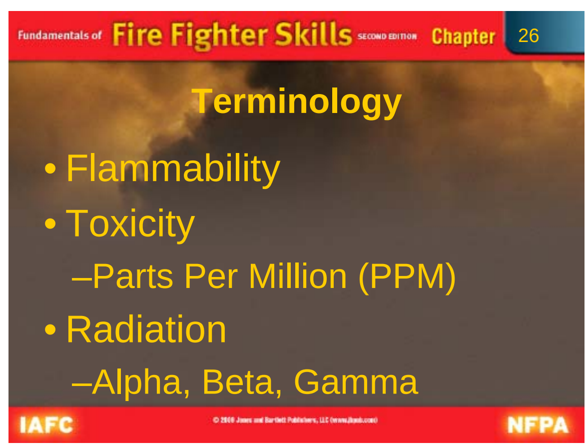
XVII) **Principles of Detection**

A) Catalytic Filament – Catalytic Bead
   1) Wheatstone Bridge
   2) Electro-Chemical
B) Colorimetric
   1) PH Paper, Classifier Strips, Reagent Tubes
C) Ionization
   1) Photo
   2) Flame
   3) Radiation




XVIII) **Terminology**

A) Flammability
   1) A Measure Of The Extent To Which A Material Will Support Combustion.
   2) Flammable Liquid: Any Liquid Having A Flash Point Below 100 Deg. F.
B) Toxicity
   1) Parts Per Million (PPM)
C) Radiation
   1) Alpha, Beta, Gamma




**Instructor Note:** Toxicity and ability of the chemicals to be absorbed by the body through normal entry routes.

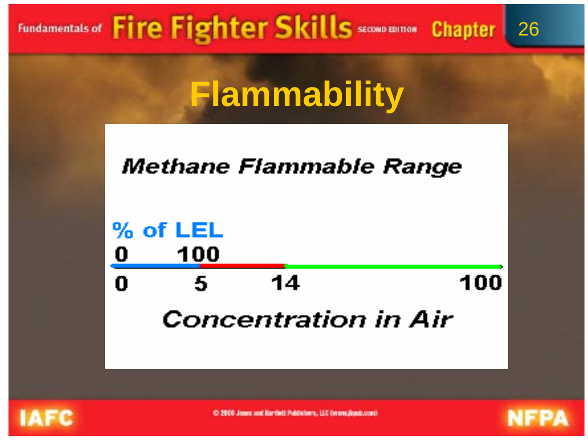
**XIX) Flammability**

A) Flammable Range

1) The *Flammable Range* (Explosive Range) Is The Range Of A Concentration Of A Gas Or Vapor That Will Burn (Or Explode) If An Ignition Source Is Introduced.

2) The Example Here Is Of Methane.

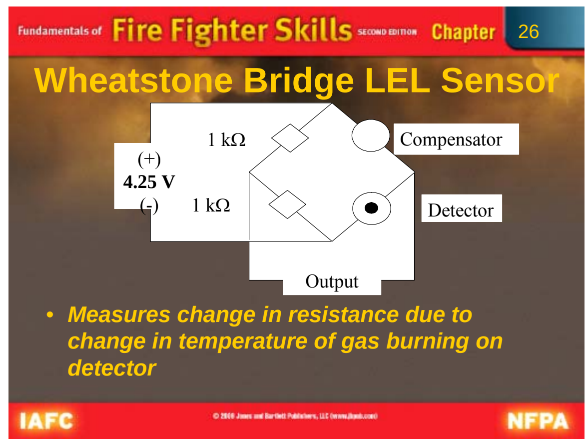
(a) Methane Has A Flammable Range Of 5% To 14%.




**Instructor Note:** Explain flammable range using different gases from the NIOSH Pocket Guide. Look up multiple gases to locate LEL then reinforce % LEL compared to % by volume.

**XX) Wheatstone Bridge LEL Sensor**

A) Measures Change In Resistance Due To Change In Temperature Of Gas Burning On Detector




**Instructor Note:** Two sides: Compensator and Detector

Compensator: Sealed resistors provide for constant measurement when compared to controlled calibration gases.

Detector: Measures/burns gas presented and compares to compensator side.

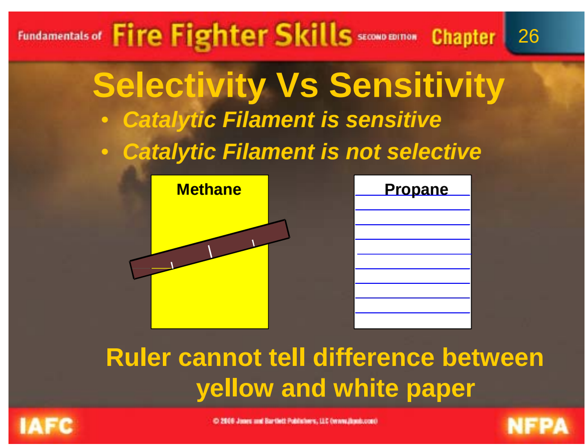
Destructible Technology: Gas gets burned and comes out a different gas.

**XXI) Selectivity Vs Sensitivity**

A) Catalytic Filament Is Sensitive

B) Catalytic Filament Is Not Selective

C) Example: A Ruler Cannot Tell The Difference Between Yellow And White Paper.




**Instructor Note:** Gas is compared to the control/calibration.

Meter does not know what the gas is; only that it can be burned.

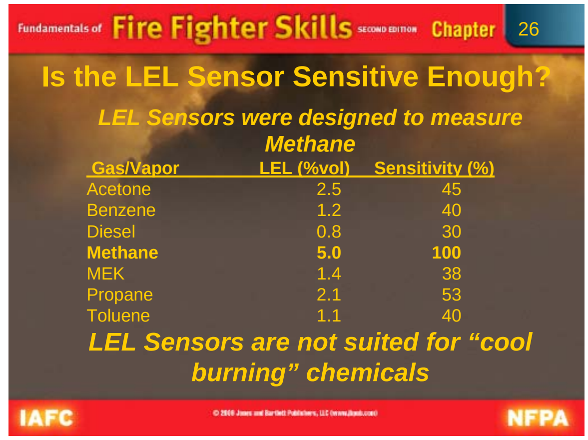
**XXII) Is The LEL Sensor Sensitive Enough?**

A) LEL Sensors Were Designed To Measure Methane.

B) LEL Sensors Are Not Suited For" Cool Burning Chemicals.

C) Listed On The Slide Are The LELs for Various Gases And Vapors, Along With Their Sensitivity.

**Instructor Note:** When compared to the calibration gases, use the correction factors to establish sensitivity to products.




**XXIII) What Is A Correction Factor?**

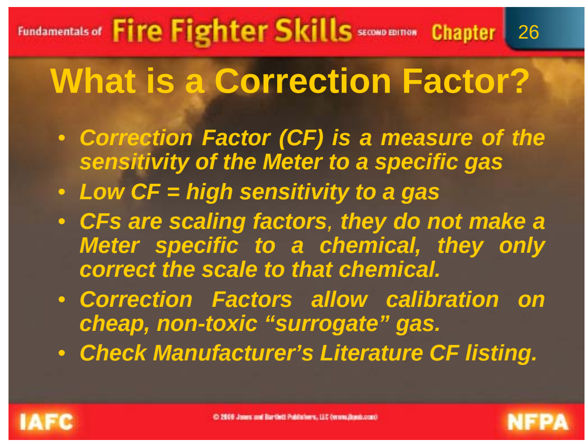
A) Correction Factor (CF) Is A Measure Of The Sensitivity Of The Meter To A Specific Gas

B) Low CF = High Sensitivity To A Gas

C) CFs Are Scaling Factors, They Do Not Make A Meter Specific To A Chemical, They Only Correct The Scale To That Chemical.

D) Correction Factors Allow Calibration On Cheap, Non-Toxic “Surrogate” Gas.

E) Check Manufacturer’s Literature CF Listing.




**XXIV) Actual Readings/Correction Factors**

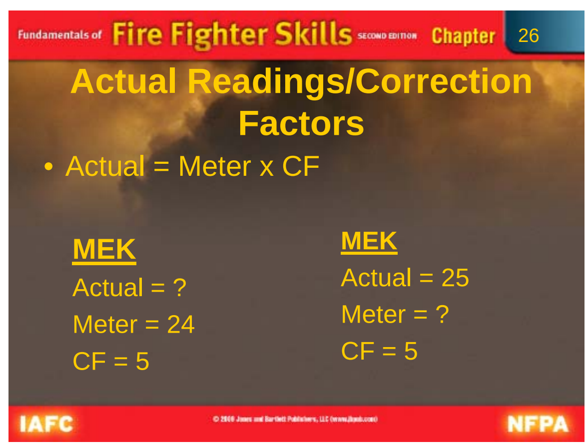
A) Actual Concentration = Meter Reading X Correction Factor

B) For MEK The Correction Factor Is 5.

C) If The Meter Reading Is 24 Then The Actual Concentration Is 120% LEL

D) If The Actual Concentration Is 25 then The Meter Will Read 5% LEL.

**Instructor Note:** Utilize NIOSH Guide to look up multiple gases and have students calculate the Correction Factor.

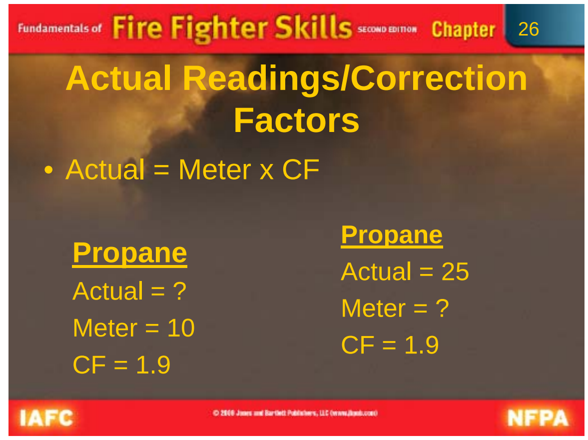



Use the Correction Factor tables to have students look up the CF and apply meter readings.

MEK = Methyl Ethyl Ketone

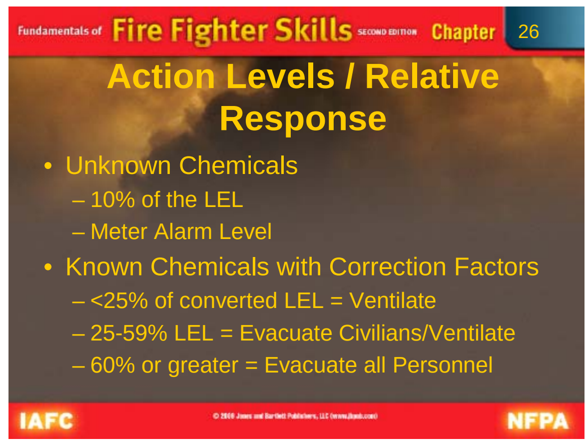
XXV) **Actual Readings/Correction Factors**

A) Actual Concentration = Meter Reading X Correction Factor
B) For Propane The Correction Factor Is 1.9.
C) If The Meter Reading Is 10 Then The Actual Concentration is 19% LEL
D) If The Actual Concentration Is 25 then The Meter Will Read 13% LEL.




XXVI) **Action Levels / Relative Response**

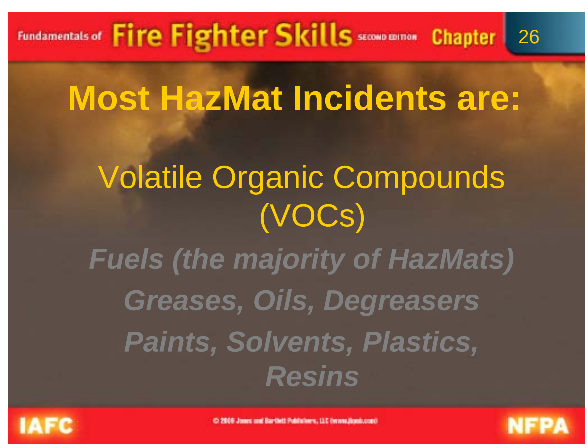
A) Unknown Chemicals
   1) 10% of the LEL
   2) Meter Alarm Level
B) Known Chemicals with Correction Factors
   1) <25% Of Converted LEL = Ventilate
   2) 25-59% LEL = Evacuate Civilians/Ventilate
   **3)** 60% Or Greater = Evacuate All Personnel




XXVII) **Most HazMat Incidents are:**

A) Volatile Organic Compounds (VOCs)
B) Fuels (The Majority Of Hazmats)
C) Greases, Oils, Degreasers
D) Paints, Solvents, Plastics, Resins

**Instructor Note:** Reinforce that the majority of responses we make as fire fighters are chemicals that are VOCs. Those that are carbon based and can burn.



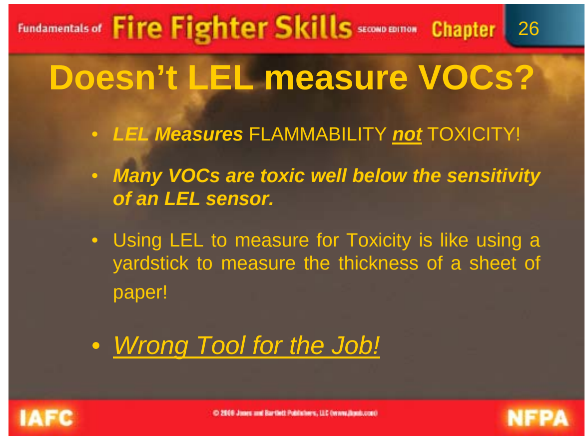
**XXVIII) Doesn't LEL measure VOCs?**

A) **LEL Measures** FLAMMABILITY **Not** TOXICITY!

**B) Many VOCs Are Toxic Well Below The Sensitivity Of An LEL Sensor.**

1) Using LEL To Measure For Toxicity Is Like Using A Yardstick To Measure The Thickness Of A Sheet Of Paper!

C) Wrong Tool For The Job!




**Instructor Note:** Relate in the next few slides the conversion of ppm to % LEL. Many gases are very toxic before they reach a reading of 1% LEL. Use Benzene as an example.

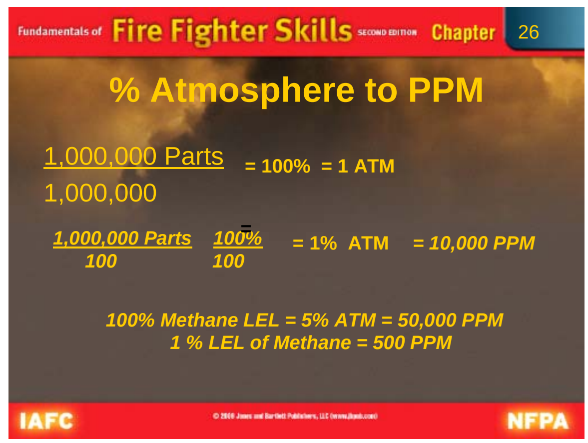
**XXIX) % Atmosphere to PPM**

A) 1,000,000 Parts Divided By 1,000,000 = 100% ATM

B) 10,000 ppm = 10% ATM

C) 100% Methane LEL equals 5% ATM or 50,000 ppm.

D) 1% LEL Of Methane = 500 ppm



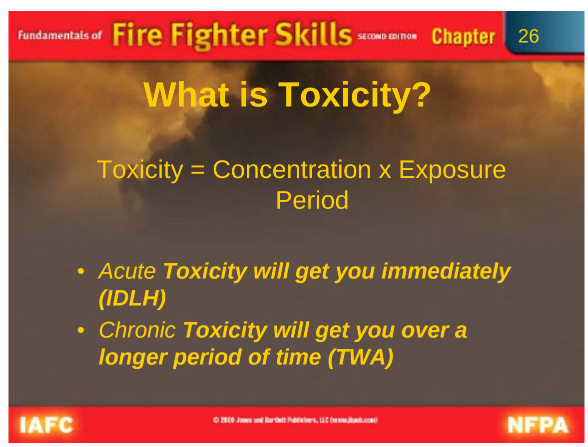

**XXX) What is Toxicity?**

A) Toxicity = Concentration x Exposure Period

B) Acute Toxicity will get you immediately (IDLH)

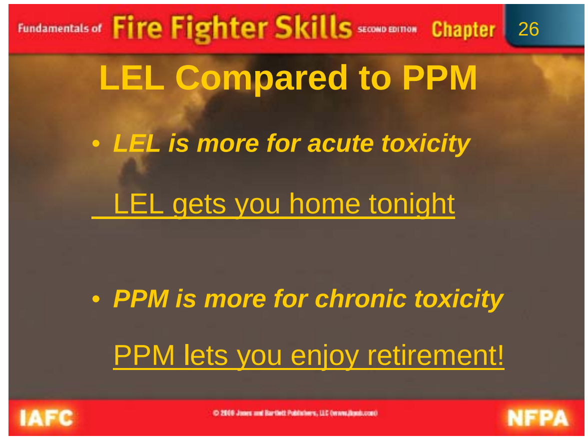
C) Chronic Toxicity will get you over a longer period of time (TWA)

**Instructor Note:** Time/Distance/Shielding concept. Concentration with exposure time.



**XXXI) <u>LEL Compared to PPM</u>**

A) <u>LEL is more for acute toxicity</u>
B) <u>LEL gets you home tonight</u>
C) <u>PPM is more for chronic toxicity</u>
D) <u>PPM lets you enjoy retirement!</u>

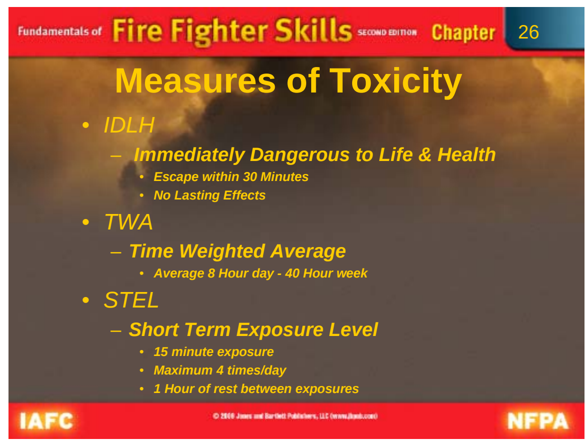



**Instructor Note:** LEL Keeps you safe from going BOOM!

PPM gives you exposure limits for long term monitoring of exposures.

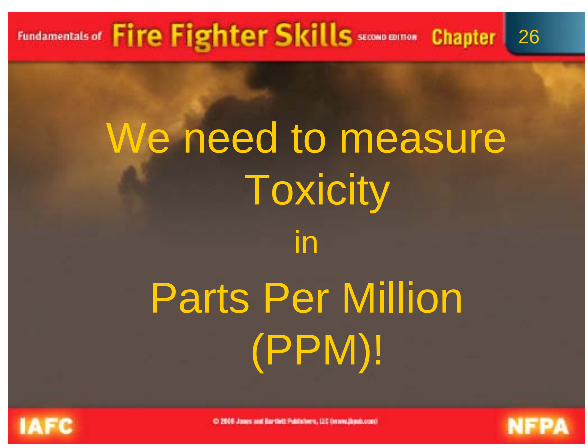
**XXXII) <u>Measures of Toxicity</u>**

A) <u>IDLH</u>
   1) <u>Immediately Dangerous to Life & Health</u>
      (a) <u>Escape within 30 Minutes</u>
      (b) <u>No Lasting Effects</u>
B) <u>TWA</u>
   1) <u>Time Weighted Average</u>
      (a) <u>Average 8 Hour day - 40 Hour week</u>
C) <u>STEL</u>
   1) <u>Short Term Exposure Level</u>
      (a) <u>15 minute exposure</u>
         (i) <u>Maximum 4 times/day</u>
         (ii) <u>1 Hour of rest between exposures</u>




**Instructor Note:** We as fire fighters live by IDLH. IDLH numbers are important for us to identify.

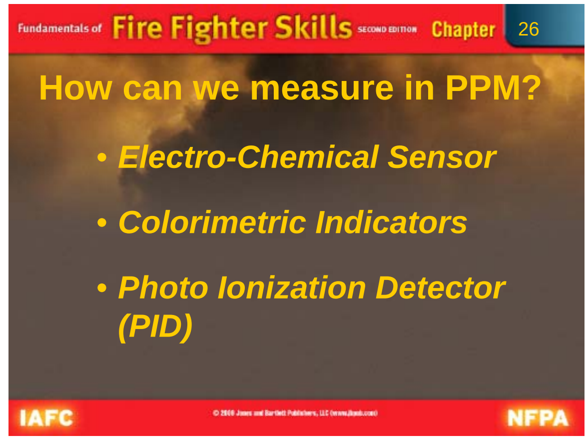
**XXXIII) <u>We Need To Measure Toxicity In Parts Per Million, Ppm!</u>**



**XXXIV) How Can We Measure In PPM?**
A) Electro-Chemical Sensor
B) Colorimetric Indicators
C) Photo Ionization Detector (PID)

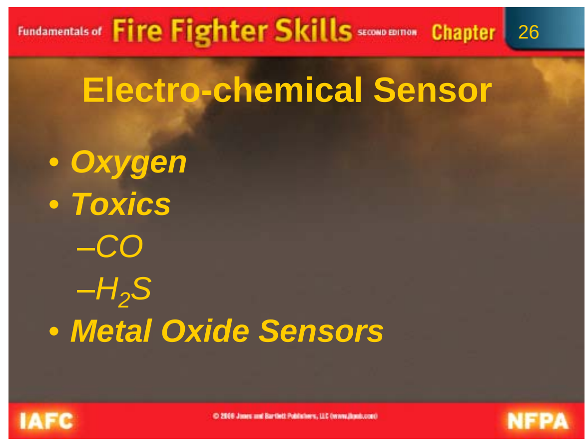
**Instructor Note:** a. Electro-Chemical sensors – H2S, CO

b. Colormetric Indicators: Colormetric tubes
c. Photo Ionization Detector

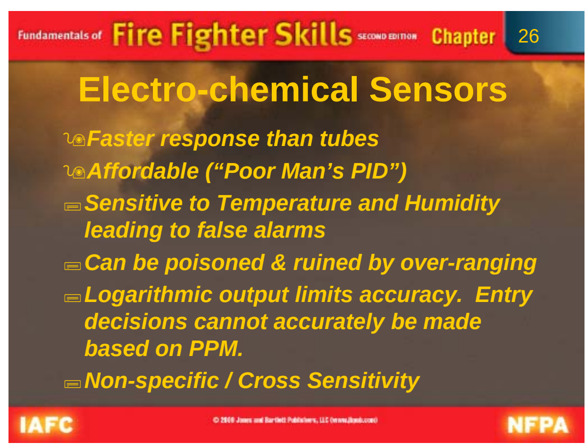



**XXXV) Electro-Chemical Sensor**
A) Oxygen
B) Toxics
1) CO
2) $H_2S$
C) Metal Oxide Sensors

**Instructor Note:** Solid state technology. Newer technology is better dealing with moisture and cold.



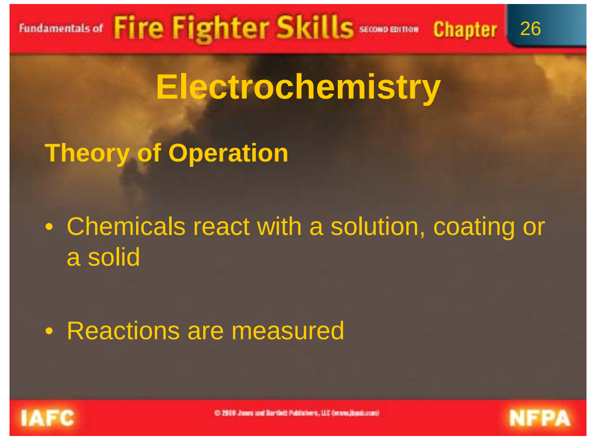

**XXXVI) Electro-Chemical Sensors**
A) Faster response than tubes
B) Affordable ("Poor Man's PID")
C) Sensitive to Temperature and Humidity leading to false alarms
D) Can be poisoned & ruined by over-ranging
E) Logarithmic output limits accuracy. Entry decisions cannot accurately be made based on PPM.
F) Non-specific / Cross Sensitivity



XXXVII) **Electrochemistry**

A) **Theory of Operation**

1) Chemicals react with a solution, coating or a solid
2) Reactions are measured

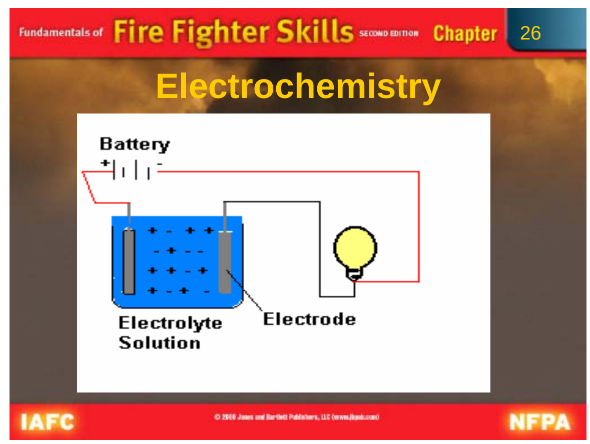



XXXVIII) **Electrochemistry**

**Instructor Note:** Electrolyte solution just like in high school chemistry class.

Distilled water / two electrode wires, battery and light bulb.

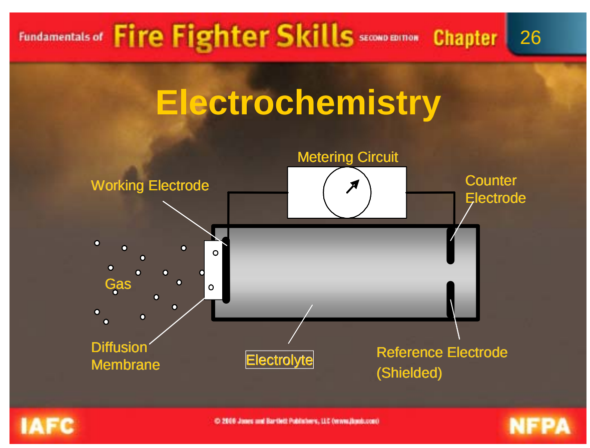
Add salt to the distilled water and provides electrons to be able to transmit electricity through the circuitry.



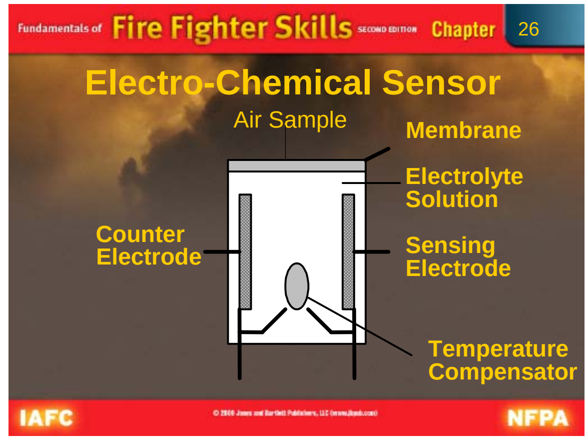

XXXIX) **Electrochemistry**

**Instructor Note:** Electrochemical Sensors: Takes in a specific gas, changes/increases the ability of the electrolyte solution to conduct electrons.

When compared to control/calibrated side, measures resistance and compares to the control.



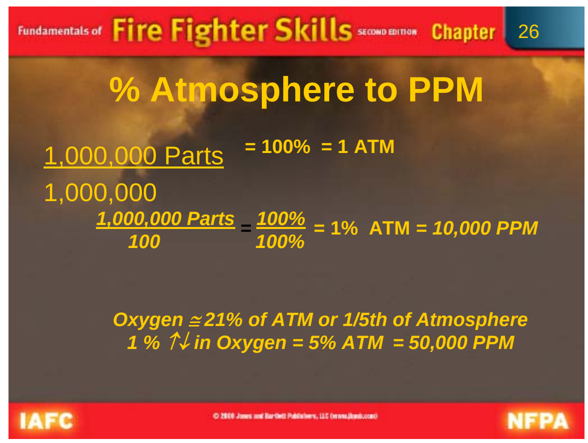
**XL) Electro-Chemical Sensor**




**XLI) % Atmosphere to PPM**

A) 1,000,000 Parts Per Million = 100% Or 1 ATM
B) 1% ATM = 10,000 ppm
C) Oxygen = 21% ATM or 1/5$^{th}$ of The Atmosphere
D) 1% More or Less Of Oxygen Equals 5% ATM Or 50,000 ppm.

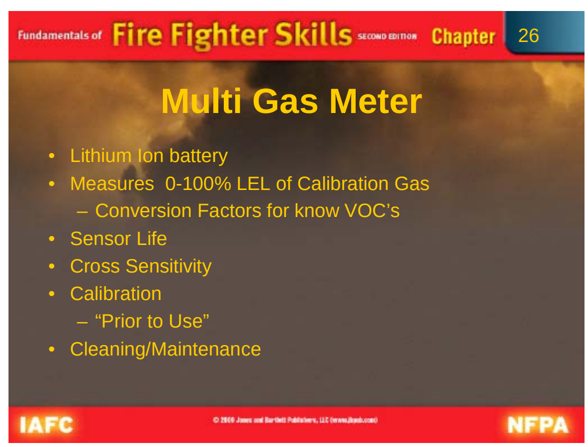
**Instructor Note:** Reinforce that a 1% drop in oxygen is equal to 50,000 ppm of something else.




**XLII) Multi Gas Meter**

A) Lithium Ion or Nickel Metal Hydride battery
B) Measures 0-100% LEL of Calibration Gas
   1) Conversion Factors for know VOC's
C) Sensor Life
D) Cross Sensitivity
E) Calibration
   1) Prior to Use"
F) Cleaning/Maintenance

**Instructor Note:** Some meters at 100% LEL will switch over to % gas.




Sensor life: Oxygen is about 1 year – always monitoring. H2S, CO and LEL approx. 1-2 years dependent on exposure to gas.

Many sensors are cross sensitive to other gases. Sensors will give false readings.
Follow manufacturer's recommendations prior to use. MHFA guidelines are to calibrate every month.
Conduct a bump test every week. Perform a Fresh Air calibration every use.
Cleaning: Mild soap solution, wipe down, Do Not immerse the unit in water.

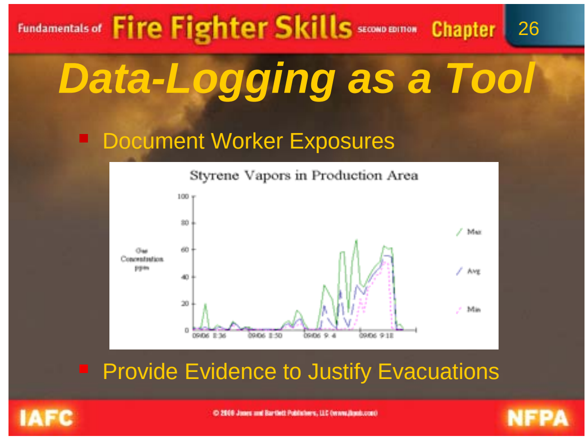
**XLIII) Data-Logging as a Tool**

A) Document Worker Exposures

B) Provide Evidence To Justify Evacuations

**Instructor Note:** Use examples to reinforce points. Used for hygiene – to document levels of exposure.

Large apartment complexes, nursing homes. Can be helpful in documenting that no hazards exist.



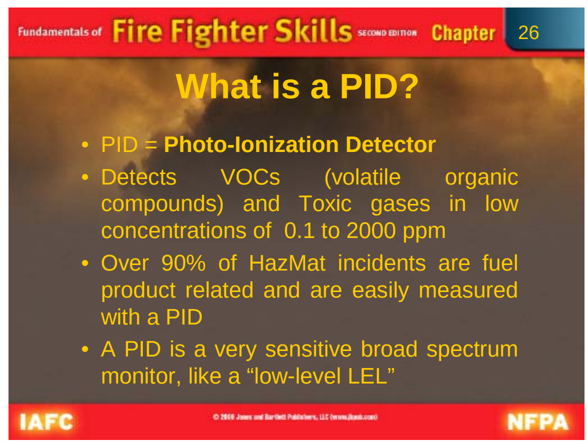

**XLIV) What is a PID?**

**A)** PID = **Photo-Ionization Detector**

B) Detects VOCs (volatile organic compounds) and Toxic gases in low concentrations of 0.1 to 2000 ppm

C) Over 90% of HazMat incidents are fuel product related and are easily measured with a PID

D) A PID is a very sensitive broad spectrum monitor, like a "low-level LEL"



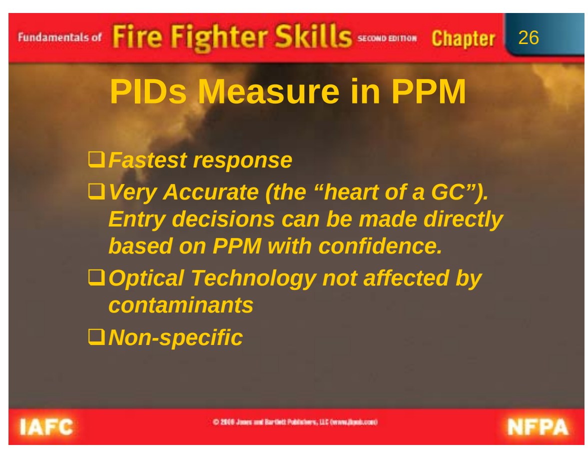

**XLV) PIDs Measure in PPM**

A) Fastest response

B) Very Accurate (the "heart of a GC"). Entry decisions can be made directly based on PPM with confidence.

C) Optical Technology not affected by contaminants

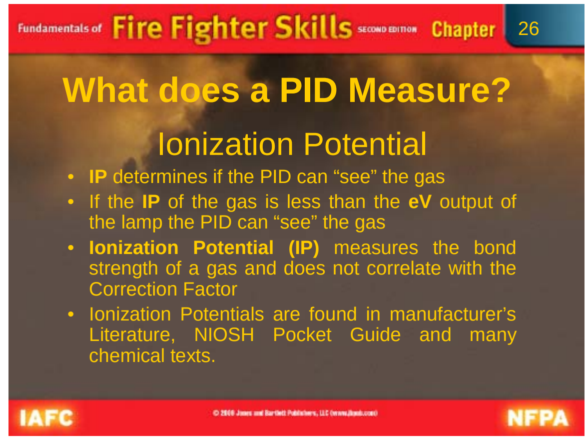
D) Non-specific



**XLVI) What does a PID Measure?**

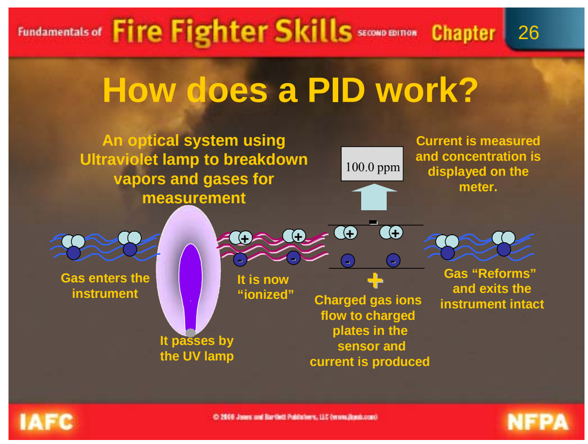
A) Ionization Potential

1) **IP** determines if the PID can "see" the gas
2) If the **IP** of the gas is less than the **eV** output of the lamp the PID can "see" the gas
3) **Ionization Potential (IP)** measures the bond strength of a gas and does not correlate with the Correction Factor
4) Ionization Potentials are found in manufacturer's Literature, NIOSH Pocket Guide and many chemical texts.




**XLVII) How does a PID work?**

A) An Optical System Using Ultraviolet Lamp To Breakdown Vapors And Gases For Measurement.



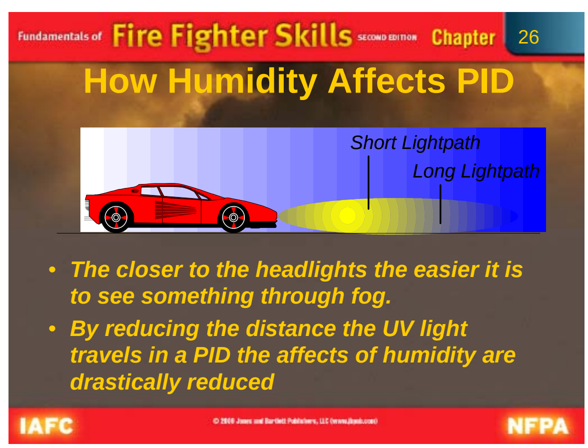

**XLVIII) How Humidity Affects PID**

A) The closer to the headlights the easier it is to see something through fog.

B) By reducing the distance the UV light travels in a PID the affects of humidity are drastically reduced

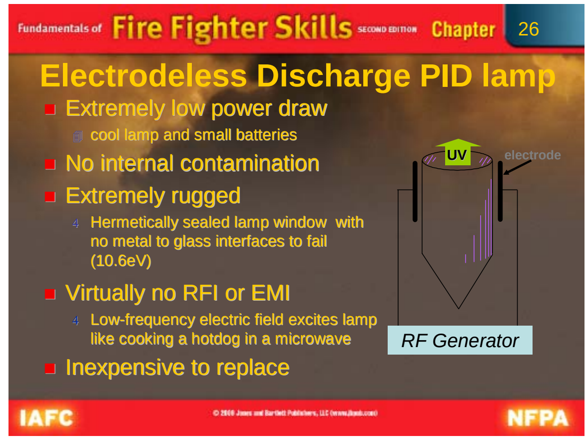
**Instructor Note:** Gas enters the unit, is exposed to the UV lamp. The gas is "ionized, arranged and split positive & negative, measured and reforms then exist as same gas.

Non-destructive technology.



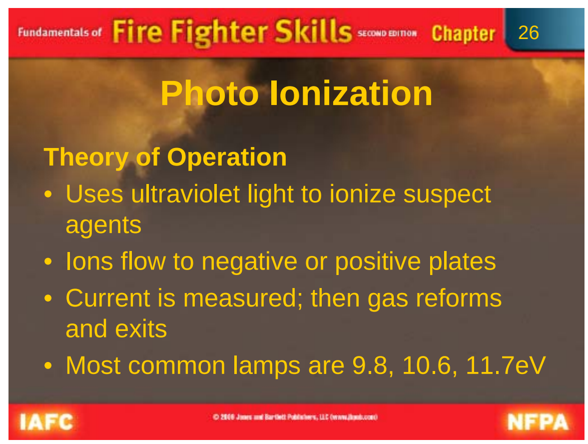
**XLIX) Electrodeless Discharge PID lamp**

A) Extremely Low Power Draw
   1) Cool Lamp And Small Batteries
B) No Internal Contamination
C) Extremely Rugged
   1) Hermetically Sealed Lamp Window With No Metal To Glass Interfaces To Fail (10.6eV)
D) Virtually No RFI Or EMI
   1) Low Frequency Electric Field Excites Lamp Like Cooking A Hotdog In A Microwave
E) Inexpensive To Replace



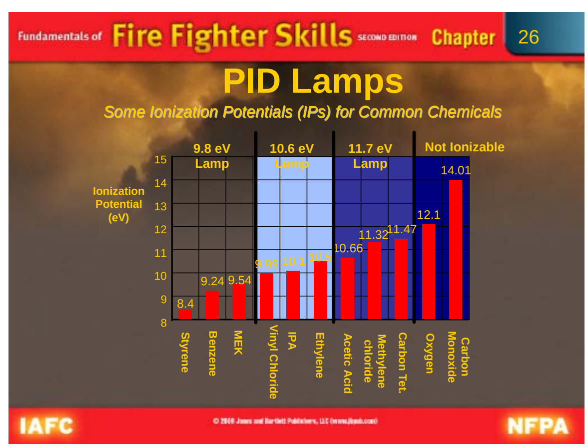

**L) Photo Ionization**

A) Theory of Operation
   1) Uses ultraviolet light to ionize suspect agents
   2) Ions flow to negative or positive plates
   3) Current is measured; then gas reforms and exits
   4) Most common lamps are 9.8, 10.6, 11.7eV




**LI) PID Lamps**

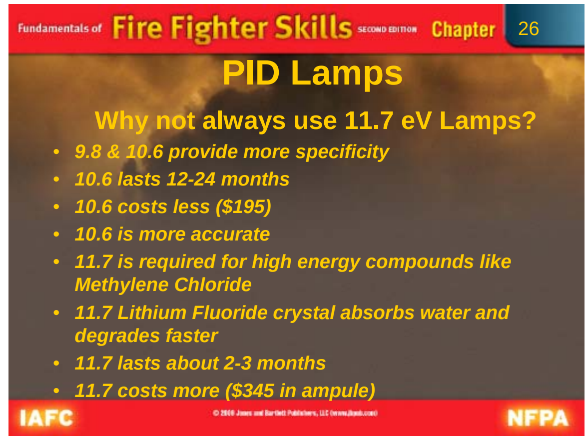
A) Listed On The Chart Are Ionization Potentials For Common Chemicals



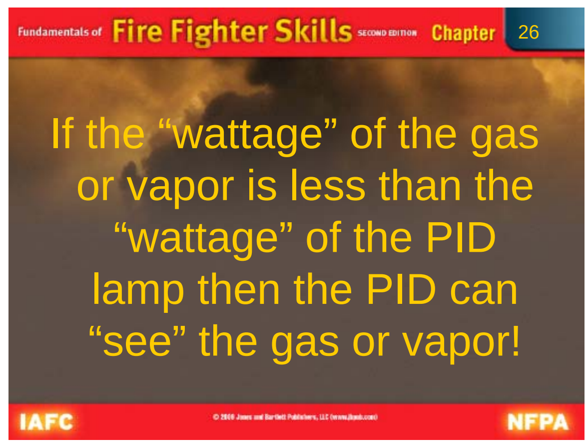
**LII) <u>PID Lamps</u>**

A) <u>Why not always use 11.7 eV Lamps?</u>

1) <u>9.8 & 10.6 provide more specificity</u>
2) <u>10.6 lasts 12-24 months</u>
3) <u>10.6 costs less ($195)</u>
4) <u>10.6 is more accurate</u>
5) <u>11.7 is required for high energy compounds like Methylene Chloride</u>
6) <u>11.7 Lithium Fluoride crystal absorbs water and degrades faster</u>
7) <u>11.7 lasts about 2-3 months</u>
8) <u>11.7 costs more ($345 in ampule)</u>



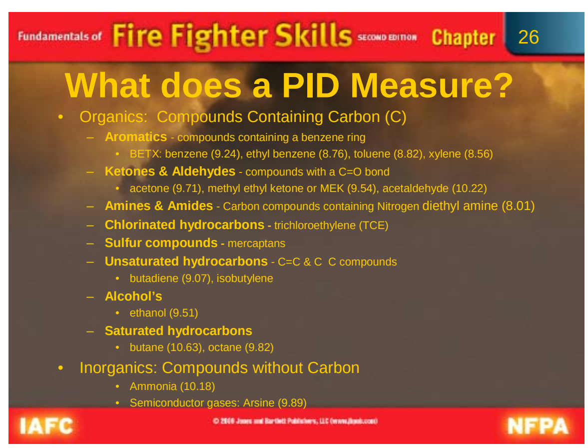

LIII) <u>If the “wattage” of the gas or vapor is less than the “wattage” of the PID lamp then the PID can “see” the gas or vapor!</u>




**LIV) <u>What does a PID Measure?</u>**

A) <u>Organics: Compounds Containing Carbon (C)</u>

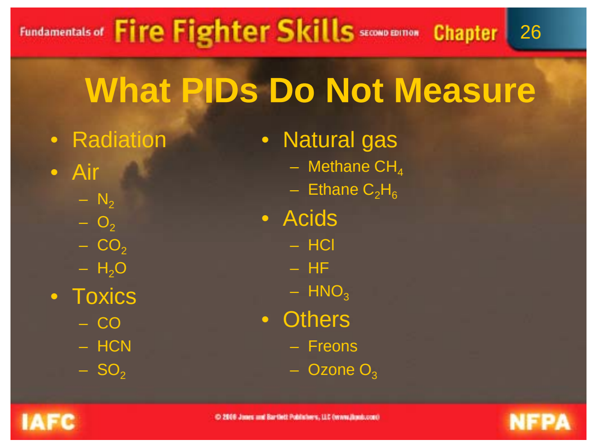
1) <u>**Aromatics -** compounds containing a benzene ring</u>
   (a) <u>BETX: benzene (9.24), ethyl benzene (8.76), toluene (8.82), xylene (8.56)</u>
2) <u>**Ketones & Aldehydes -** compounds with a C=O bond</u>
   (a) <u>acetone (9.71), methyl ethyl ketone or MEK (9.54), acetaldehyde (10.22)</u>
3) <u>**Amines & Amides** - Carbon compounds containing Nitrogen diethyl amine (8.01)</u>
4) <u>**Chlorinated hydrocarbons -** trichloroethylene (TCE)</u>
5) <u>**Sulfur compounds –** mercaptans</u>



6) **Unsaturated hydrocarbons -** C=C & C C compounds
   (a) butadiene (9.07), isobutylene
7) **Alcohol's**
   (a) ethanol (9.51)
8) **Saturated hydrocarbons**
   (a) butane (10.63), octane (9.82)

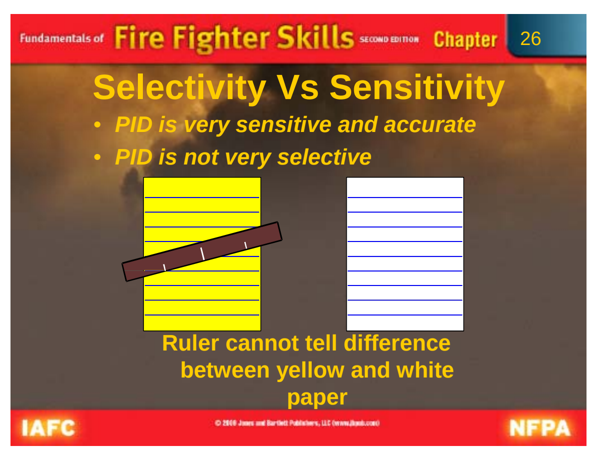
B) Inorganics: Compounds without Carbon
   1) Ammonia (10.18)
   2) Semiconductor gases: Arsine (9.89)

## LV) What PIDs Do Not Measure




A) Radiation
B) Air
   1) $N_2$
   2) $O_2$
   3) $CO_2$
   4) $H_2O$
C) Toxics
   1) CO
   2) HCN
   3) $SO_2$
D) Natural gas
   1) Methane $CH_4$
   2) Ethane $C_2H_6$
E) Acids
   1) HCl
   2) HF
   3) $HNO_3$
F) Others
   1) Freons
   2) Ozone $O_3$

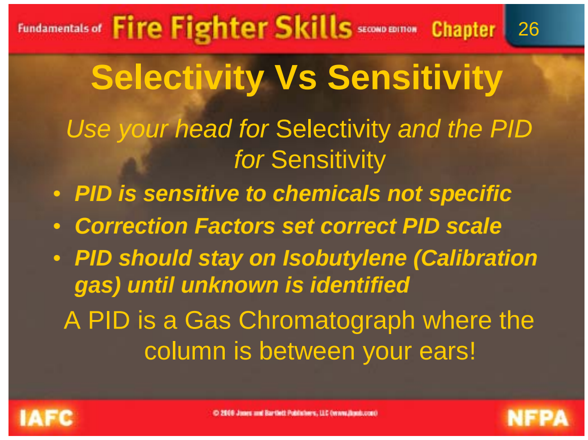
## LVI) Selectivity Vs Sensitivity




A) PID is very sensitive and accurate
B) PID is not very selective
C) The Ruler Cannot Tell The Difference Between Yellow And White Paper.

LVII) **<u>Selectivity Vs Sensitivity</u>**

A) <u>Use your head for Selectivity and the PID for Sensitivity</u>
B) <u>PID is sensitive to chemicals not specific</u>
C) <u>Correction Factors set correct PID scale</u>
D) <u>PID should stay on Isobutylene (Calibration gas) until unknown is identified</u>
E) <u>A PID is a Gas Chromatograph where the column is between your ears!</u>



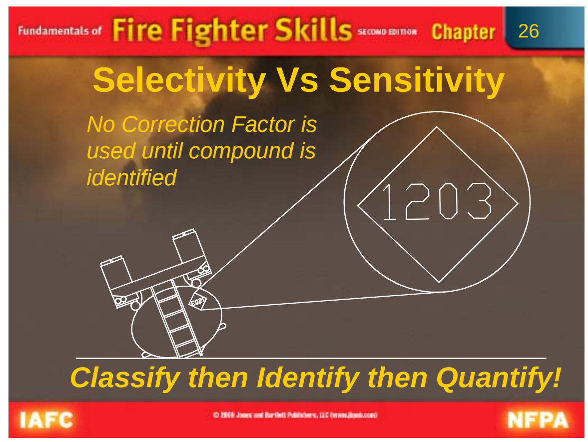

LVIII) **<u>Selectivity Vs Sensitivity</u>**

**A)** <u>No Correction Factor Is Used Until A Compound Is Identified</u>
**B)** <u>Classify Then Identify Then Quantify!</u>

**Instructor Note:** Identify the hazard class.

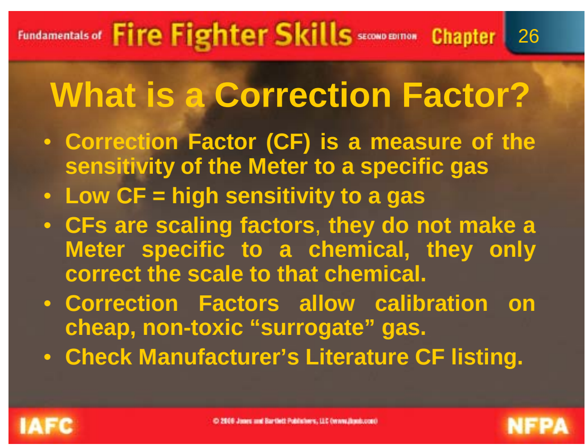
Use alternate means to identify the hazard class.

The first priority is to determine if there is a hazard. Then we will quantify how much of a hazard there is.




LIX) **<u>What is a Correction Factor?</u>**

A) <u>Correction Factor (CF) is a measure of the sensitivity of the Meter to a specific gas</u>
B) <u>Low CF = high sensitivity to a gas</u>
C) <u>CFs are scaling factors, they do not make a Meter specific to a chemical, they only correct the scale to that chemical.</u>
D) <u>Correction Factors allow calibration on cheap, non-toxic "surrogate" gas.</u>
E) <u>Check Manufacturer's Literature CF listing.</u>



**LX) What is a Correction Factor?**

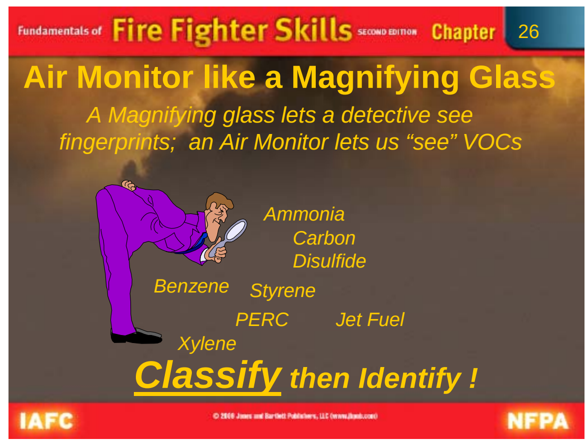
**A)** Listed On The Chart Are Correction Factors For Common Chemicals.

**Instructor Note:** Use the Correction Factor charts provided for examples.


**LXI) Air Monitor like a Magnifying Glass**

**A)** A Magnifying glass lets a detective see fingerprints; an Air Monitor lets us "see" VOCs

**B)** Classify Then Identify!




**LXII) Colormetric Indicators**

A) pH Paper

B) Classifier Strips

C) Colormetric Tubes

D) Reagent Test Kits

**Instructor Note:** Shows different indicators and classifiers. Give examples and uses to the students.

The most widely used is pH Paper.

**LXIII) Colorimetric Tubes**

A) Proven technology

B) "Snap Shots" only like a "Polaroid" camera, cannot provide continuous monitoring with alarms

C) Potential of sampling error

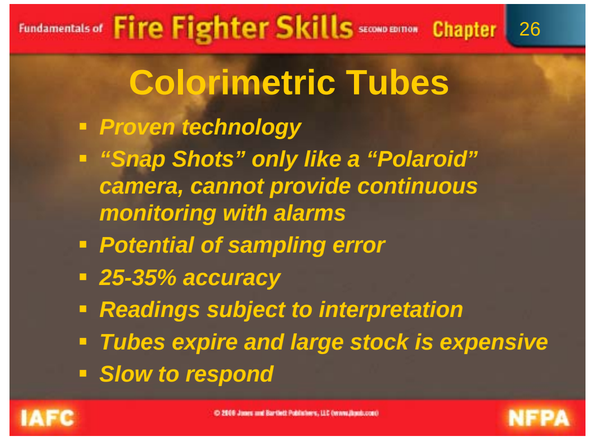
D) 25-35% accuracy

E) Readings subject to interpretation

F) Tubes expire and large stock is expensive

G) Slow to respond

LXIV)




**LXV) Corrosives**

A) pH Paper Utilization

1) Measures Acid & Bases

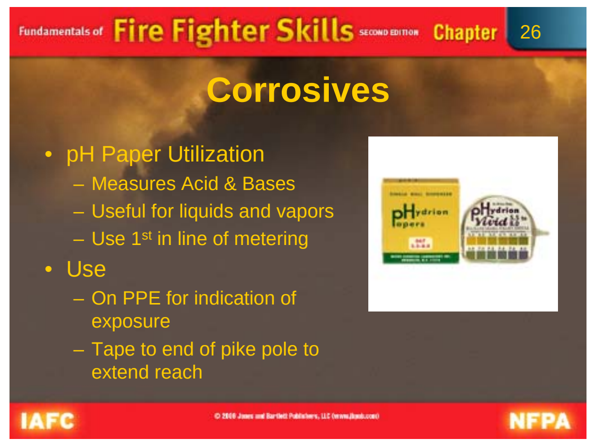
2) Useful for liquids and vapors

3) Use 1st in line of metering

B) Use

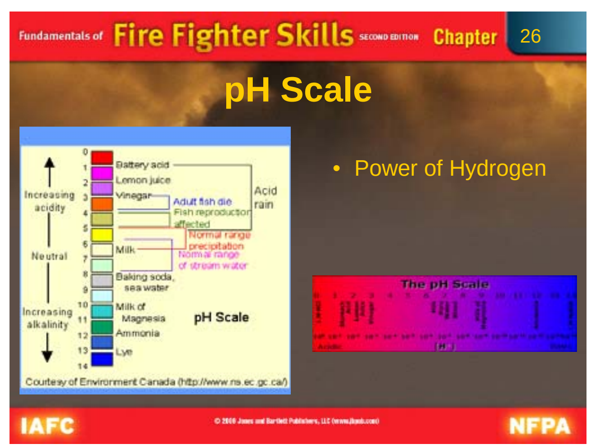
1) On PPE for indication of exposure

2) Tape to end of pike pole to extend reach



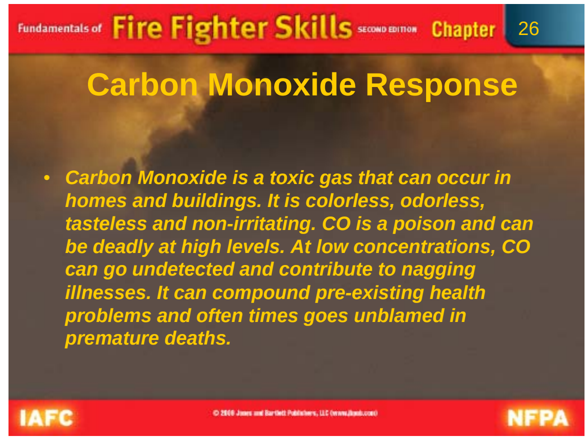

**LXVI) pH Scale**

A) Power of Hydrogen



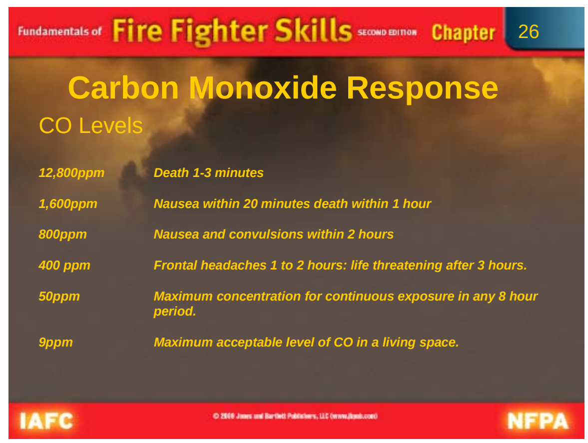
**LXVII) Carbon Monoxide Response**

A) Carbon Monoxide is a toxic gas that can occur in homes and buildings. It is colorless, odorless, tasteless and non-irritating. CO is a poison and can be deadly at high levels. At low concentrations, CO can go undetected and contribute to nagging illnesses. It can compound pre-existing health problems and often times goes unblamed in premature deaths.

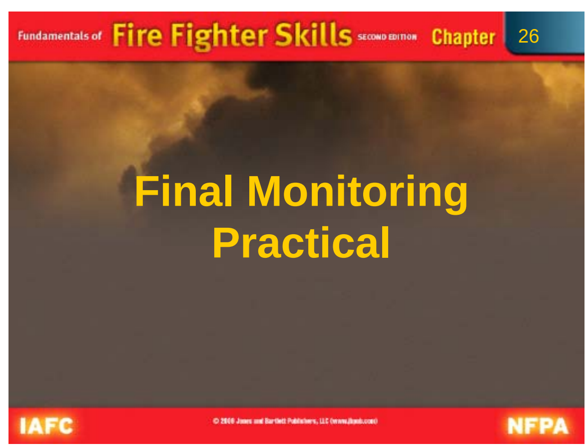



**LXVIII) Carbon Monoxide Response**

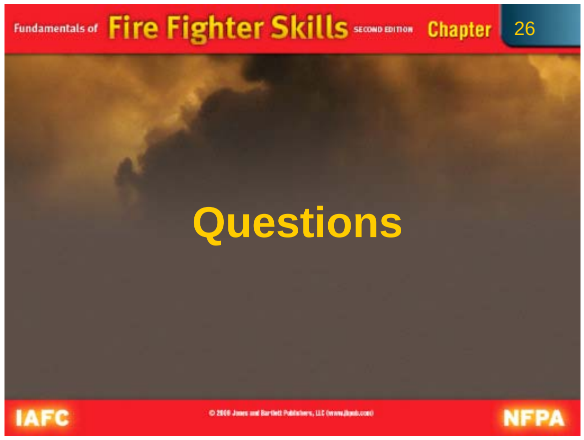
A) **12,800 ppm, Death In 1-3 Minutes**
B) **1,600 ppm, Nausea Within 20 Minutes, Death Within 1 Hour**
C) **800 ppm, Nausea And Convulsions Within 2 Hours**
D) **400 ppm, Frontal Headaches 1 to 2 Hours; Life Threatening After 3 Hours.**
E) **50 ppm, Maximum Concentration For Continuous Exposure In Any 8 Hour Period.**
F) **9 ppm, Maximum Acceptable Level Of CO In A Living Space.**




**LXIX) Final Monitoring Practical**



**LXX) <u>Questions</u>**



## APPLICATION:

There are 3 Skill Drills to be presented. The Skill Drills are listed on the disk provided in the section named 'Skill Drills'. The Air Monitoring Skill Drills are numbered ITRS-1-1 Operate A Four Gas Meter, ITRS-1-2, Operate A Photo Ionization Detector, and ITRS-1-3, Utilize Litmus Per.

Two to two (2) hours is recommended for conducting the required skills. The suggested method for conducting the Skills is as follows:

Divide the class into two groups. One group operates the 4-gas meters and a second group operates the PID and uses litmus paper. Approximately one hour will be required to complete each station.

**INTRODUCTION TO TECHNICAL RESCUE SKILLS**
**AIR MONITORING**
**SUGGESTED EQUIPMENT LIST**

2 MSA 4-gas meters
2 MSA sirius meters
1 MSA PID 2 meter
Assorted colormetric tubes with Draeger box
Ph paper
Assorted old sensors for demo
Radiological kit/meters
WMD detection paper & 256 kit
Assorted chemicals for detection

**Instructor Note:** If any equipment needs repair or replacement please notify the **Equipment Captain** at the NH Fire Academy, 603-271-2661, ext. 31038 or the **Equipment Tech (O-51)**.

## EVALUATION:

The evaluation process will be conducted while candidates perform the skills at the two Stations.

## SUMMARY AND REVIEW:

Upon completion of the Air Monitoring portion of Introduction To Technical Rescue Skills, the candidate will possess those skills necessary to participate in all Rescue Technician programs where those skills are used.