Norfolk Fire-Rescue Carbon Monoxide Monitoring Program

Captain Nick Nelson

Norfolk Fire-Rescue

VA OEMS Symposium

November 13, 2015

NORFOLK FIRE – RESCUE

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“Don’t get in the way of outcomes you can’t change”

Dr. Richard B. Gasaway

NFR New Recruit Class

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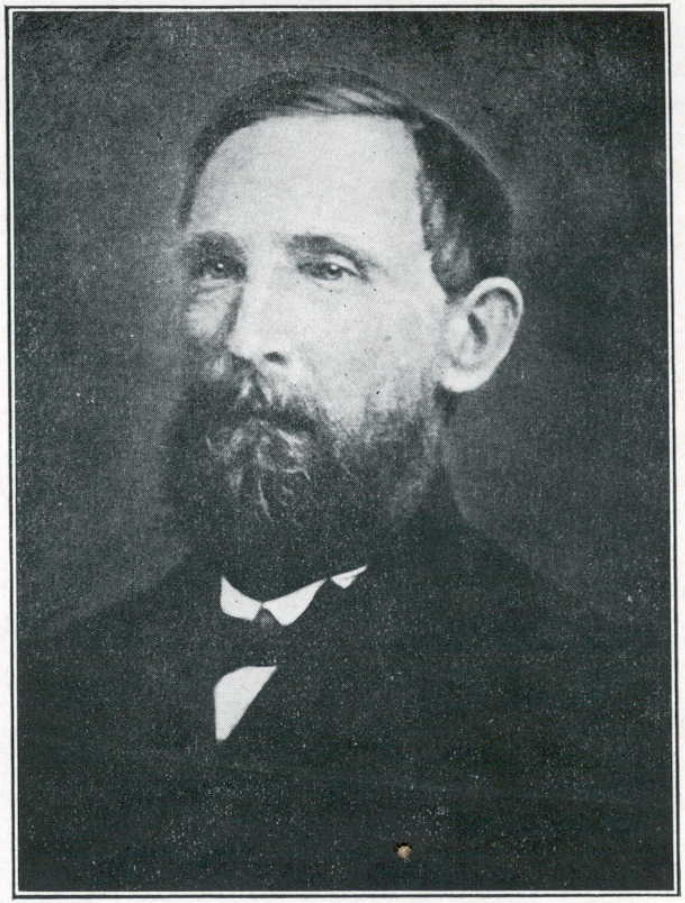
Norfolk Fire Rescue

- 1871-paid fire department
- 4th oldest paid fire department in America?
- Merged with PRS in 1991
- 500 employees
- 12 ALS ambulances
- 14 ALS fire engines
- 7 ALS ladder companies
- 2 ALS heavy rescue trucks
- 14 fire stations



THOMAS KEVILL
Norfolk's First Fire Chief

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Fire-Rescue continued

- 66 square mile urban city
- 350,000 during the workday
- Average of 40,000+ emergency incidents a year
- FY15 Budget $39,890,700

- Typically, a fire response consists of 3 engine companies, 1 ladder company, 1 rescue company, 1 battalion chief, and 1 ambulance. The ambulance crew can commit to fire suppression at working incidents

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Overview

- Introduction
- Possible sources of CO
- Carbon Monoxide (CO) properties
- CO health hazards
- CO levels and what they mean
- Response procedures
- Atmospheric monitoring
- Case studies

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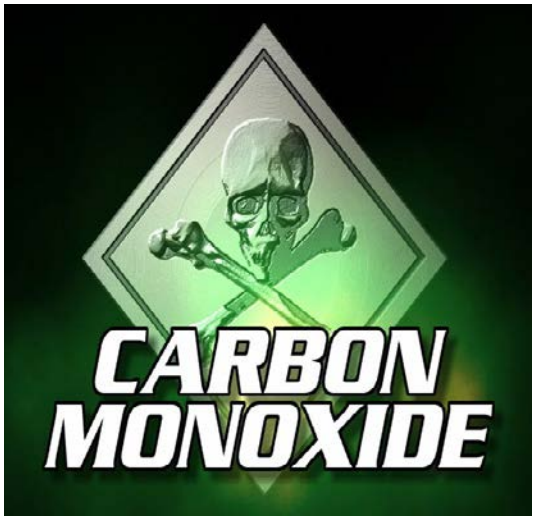
Objectives

- Familiarize personnel with the dangers and properties associated with CO
- Provide a frame-work on which to base initial response considerations
- Familiarize personnel with equipment used in the detection/monitoring of CO



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Firefighter Close Calls 10/05/15

FDNY Firefighters responding to a medical emergency in the Bronx Monday night entered what turned out to be a CO leak -- and fortunately equipment on an EMS crew coming behind them averted what would have been a really bad situation. The firefighters were reportedly unaware they had walked into a building that was literally filled with CO. It wasn't until the FDNY EMS crew from Station 15 got on the scene that an alarm was sounded.

Some 10 residents and the Firefighters evacuated from the building at E. 217th St. Four people, including the initial patient who called 911 with difficulty breathing, were taken to Jacobi Hospital for treatment of minor injuries related to the CO exposure, according to FDNY. The call that came in just before 0100 hours was for a cardiac arrest and Firefighters were the first on the scene for the emergency call, taking care of the patient, who was actually having an asthma attack.

But when FDNY EMS members from Station 15 stepped into the building, they immediately knew there was trouble. **The carbon monoxide meters the units carry with them began to go off, alerting them to the potential deadly danger.**

The first readings showed a level of 600 parts per million, which can cause nausea and headaches and can be deadly with extended exposure of three hours or more. The EMS monitors will spike at 35 parts. As the crew worked to evacuate the building residents, their alarms kept climbing, and by the time the building was emptied, the monitors were registering 1000 parts over 1 million.

None of the Firefighters or EMT's were harmed. The residents taken to Jacobi Hospital with CO-related injuries included a woman in her 40s and a man in his 60s, according to FDNY.

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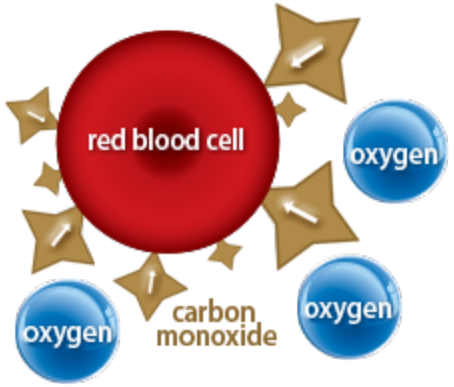
Introduction

- CO is one of the leading cause of poisoning deaths
- CO is responsible for half the poisonings world wide
- During 1999–2010, a total of 5,149 deaths from unintentional carbon monoxide poisoning occurred in the United States, an average of 430 deaths per year CDC



CO poisoning can be difficult to recognize because the symptoms mimic other illnesses.

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Introduction

Most deaths are due to:

1. House fires
2. Auto exhaust
3. Indoor heating systems
4. Stoves and other appliances
5. Gas powered generators
6. Charcoal grills
7. Water heaters

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Introduction

- CO deaths increase during disasters due to the use of generators and portable heaters
- The winter months also see increased death rates due to the use of heating systems and closed windows

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Norfolk Fire-Rescue Response

Calls with actual CO findings

2013: 64

2014: 75

2015 to date: 57

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State of VA CO Calls

VIRGINIA DEPARTMENT OF FIRE PROGRAMS

- 2015 371 through July
- 2014 986
- 2013 1,047

- VDFP Annual Report

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CO and CO2

Carbon Monoxide

Carbon monoxide is a highly poisonous, odorless, colorless, and tasteless gas. It is very flammable in air

Carbon Dioxide

Carbon dioxide (chemical formula CO2) is a colorless, odorless gas vital to life on Earth

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Carbon Monoxide Properties

- Odorless, colorless, tasteless, non-irritating gas
- CO is a Poison and can be deadly at high levels
- CO can compound pre-existing illnesses and is often blamed on pre-mature deaths
- CO is Virtually undetectable without specialized equipment

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Carbon Monoxide Properties

- Flammable Range: 12.8% to 74%
- Vapor Density: 0.968
- Vapor can rise or fall depending on temperature

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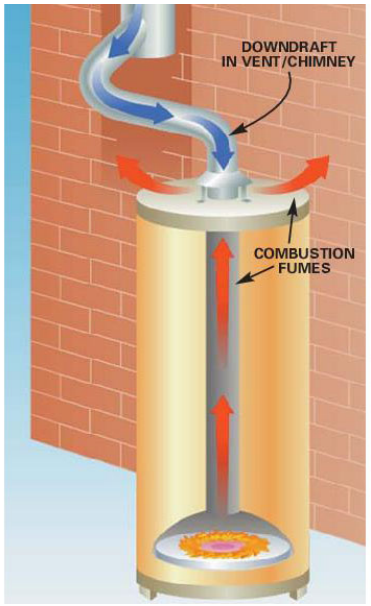
Carbon Monoxide Production

- A natural by-product of incomplete combustion from burning carbon based fuels such as:
  - Gasoline
  - Oil
  - Propane
  - Methane
  - Coal
  - Wood



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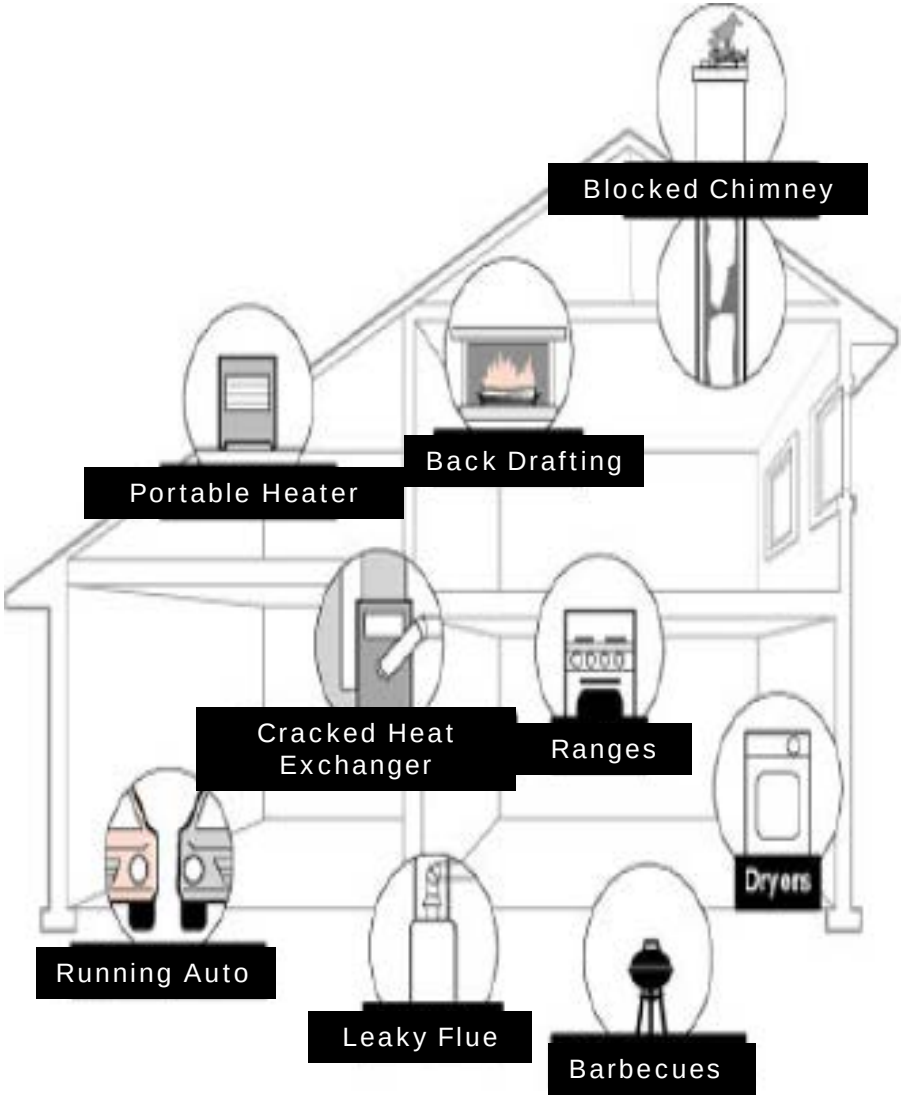
Carbon Monoxide Sources

- Attached garages with running automobiles
- Gas powered tools
- CO from sources outside
- Cooking and heating appliances
  - Improperly vented
  - Not serviced
  - Inefficient/improper operation



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Carbon Monoxide Sources

- Appliances
  - Vented: appliances that are designed to be used with a duct, chimney, pipe or other device that carry the combustion pollutants outside the home
  - Un-vented: appliances that do not vent to the outside, so they release combustion pollutants directly into the home

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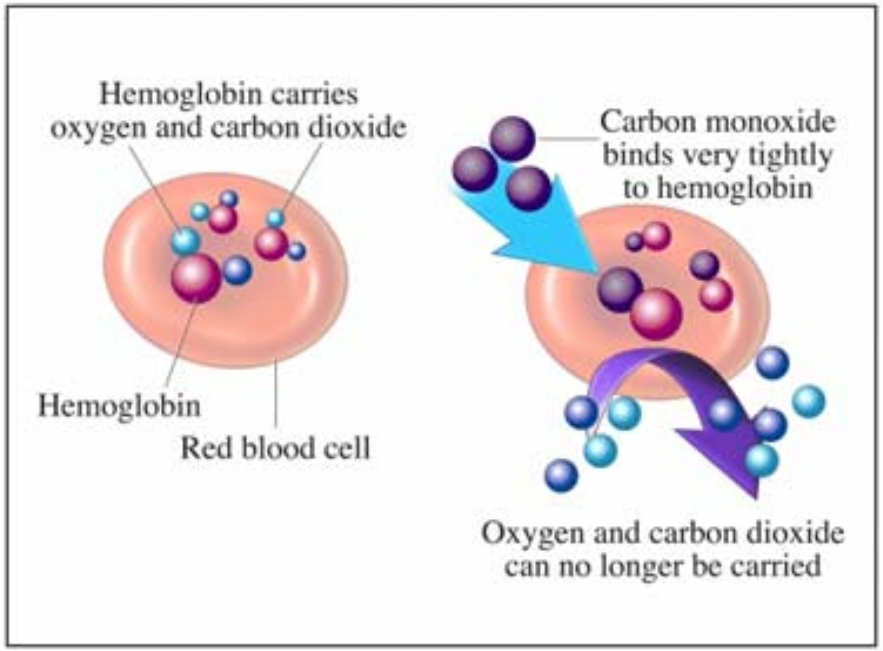
Health Hazards

- Silent Killer: CO will kill before its presence is known
- No early warning signs
- Displaces O2 in the bloodstream
- Victims die from asphyxiation



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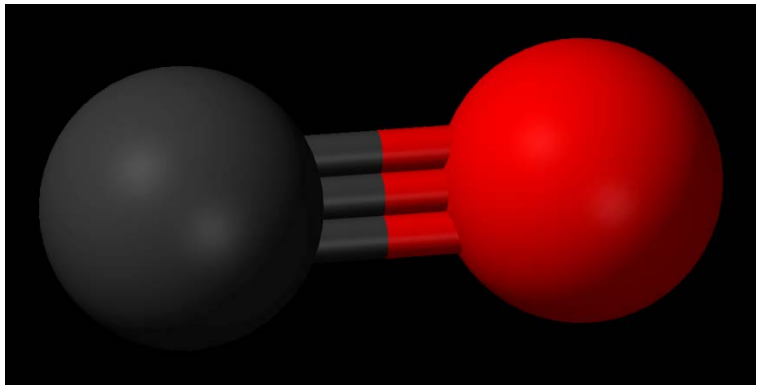
Health Hazards



- Reduced O2 reduces functions of the brain, cardiac muscle, and respiratory system
- CO has a greater affinity for hemoglobin than O2 at 210 times to 1
- COHb limits the ability of the blood to carry oxygen and effects all major organs and muscles.

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Health Hazards

- High Risk Groups
  - Infants/Children
  - Pregnancies (Fetus)
  - Elderly
  - People with Heart Conditions
  - People with Respiratory Conditions
  - Persons who are anemic

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Pulse Oximetry

Is it a reliable tool in patient assessment????????

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Carbon Monoxide Action Levels

- 9 ppm (Max Residential) EPA
- 35 ppm (Max Industry) and the Max limit per NFR SOP
- 50 ppm (OSHA PEL)

Per NFR SOP's

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Concentration	Symptoms
35 ppm	Headache/dizziness within 6 to 8 hours
100 ppm	Mild headache within 2 to 3 hours
200 ppm	Mild headache within 2 to 3 hours and loss of judgment
400 ppm	Frontal type of headache in 1 to 2 hours
800 ppm	Nausea, dizziness, and convulsions within 45 minutes
1,600 ppm	Headache, dizziness, and nausea within 20 minutes. Death in less than 2 hours
3,200 ppm	Headache, dizziness, and nausea within 5 to 10 minutes. Death within 30 minutes
6,400 ppm	Headache and dizziness in only 1 to 2 minutes. Death in less than 20 minutes
12,800 ppm	Unconsciousness with only 2 to 3 breaths and death in less than 3 minutes

Response Procedures

- Medic Units, Ladder Companies and Rescues Companies will carry single gas CO Detection equipment and Tubes.
- Rescues also carry 4 – gas meters
- Fire Prevention Inspectors carry single gas CO meters for follow-up operations

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Response Procedures

- Establish Command
- Account for all occupants
- If occupants are still in a suspect atmosphere, remove all occupants
- If occupants are missing or reported trapped, request additional resources and initiate search & rescue operations

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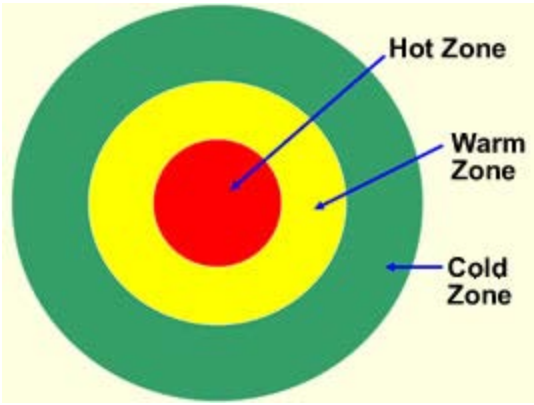
Response Procedures

- Triage all occupants for signs and symptoms of CO exposure. Treat and Transport all suspected CO patients
- Establish a hazard control perimeter (Hot, Warm, Cold)
- Conduct detection and monitoring to determine CO levels



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Treatment of CO Patient

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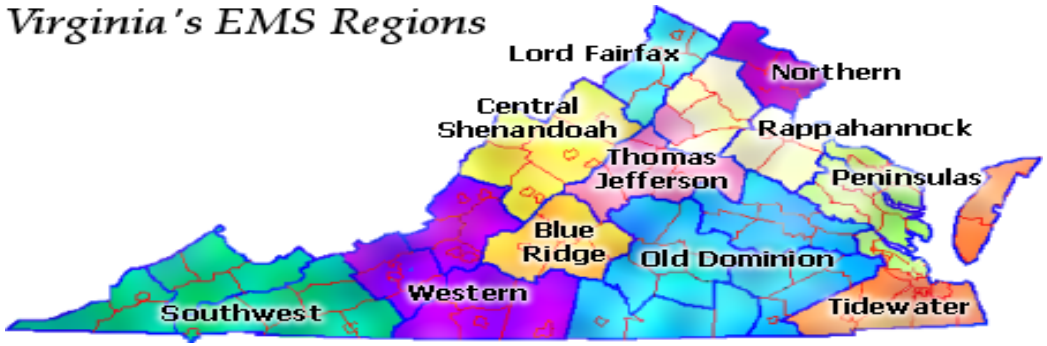
Hyperbaric Chambers in VA

Johnston Memorial Hospital	Abingdon	Southwest
Inova Mount Vernon Hospital	Alexandria	Northern
Virginia Hospital Center	Arlington	Northern
University of Virginia Hospital	Charlottesville	Thomas Jefferson
Chesapeake General Hospital	Chesapeake	Tidewater
Mary Washington Hospital	Fredericksburg	Rappahannock
Virginia Baptist Hospital	Lynchburg	Blue Ridge
Memorial Hospital of Martinsville	Martinsville	Western
Sentara Leigh	Norfolk	Tidewater
Bon Secours DePaul Hospital	Norfolk	Tidewater
Norton Community Hospital	Norton	Southwest
Capital Medical Center	Richmond	Old Dominion
Retreat Hospital	Richmond	Old Dominion
Lewis Gale Medical Center	Salem	Southwest
Halifax Regional Hospital	South Boston	Old Dominion

Virginia's EMS Regions



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Response Procedures

- Ensure unit is turned on.
- Allow the instrument to “zero” in a clean atmosphere. “never zero the instrument in the suspected atmosphere”

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Response Procedures

- Do not perform ventilation until all initial detection and monitoring is complete
- Perform detection and monitoring of all affected areas moving slowly and monitoring high and low
- Note the highest and lowest levels of concentration

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Response Procedures

- Requesting assistance from a Rescue Company:
  1. Injuries or death occur
  2. Meter reading are above the action levels
  3. Unit not working

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Response Procedures

- Report all findings via radio to command or the dispatcher
- Shut down all suspected equipment or appliances and “Red Tag” them for follow up by fire prevention
- Ventilate the structure

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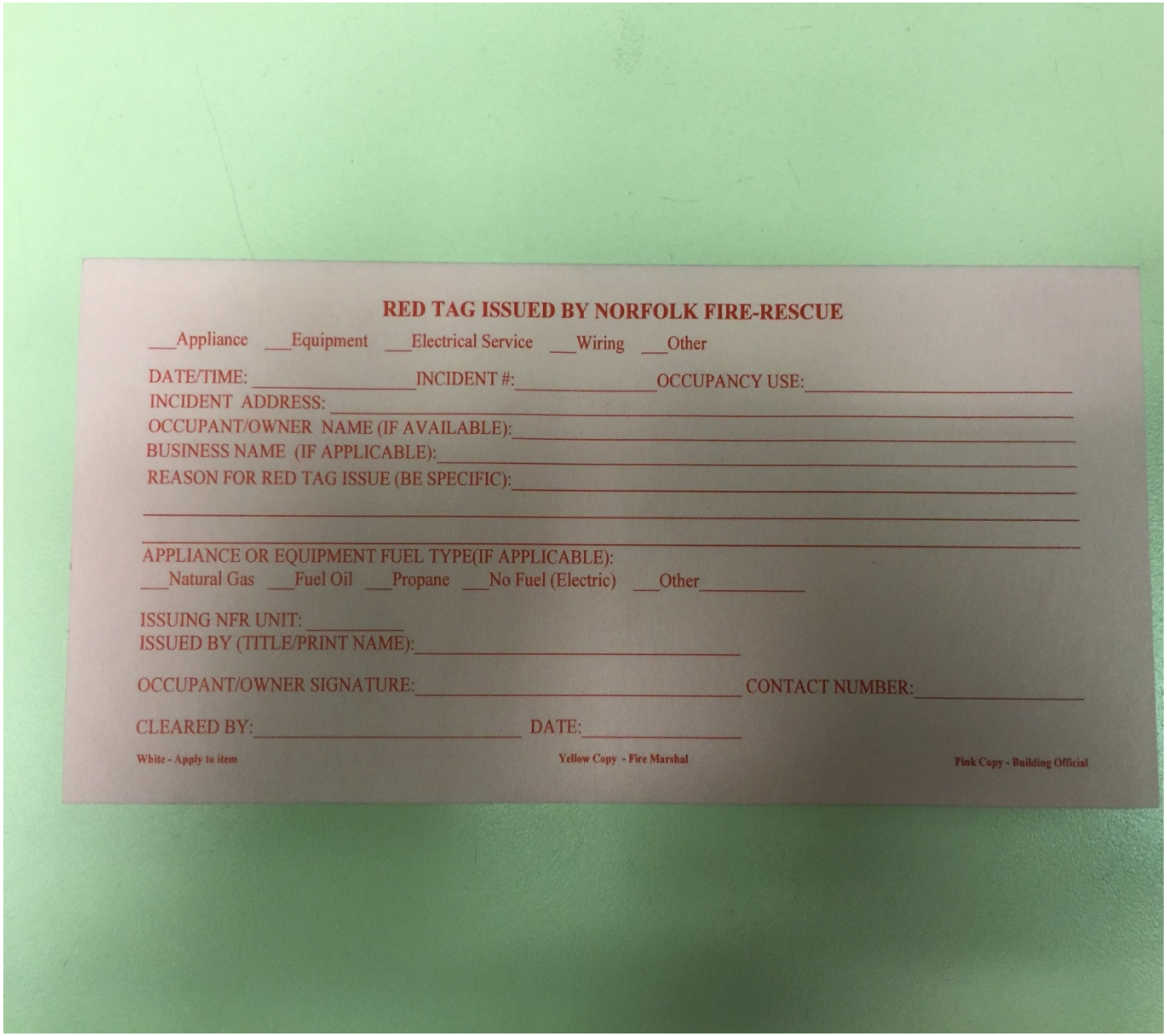

RED TAG ISSUED BY NORFOLK FIRE-RESCUE

___Appliance ___Equipment ___Electrical Service ___Wiring ___Other

DATE/TIME: _____ INCIDENT #: _____ OCCUPANCY USE: _____

INCIDENT ADDRESS: _____

OCCUPANT/OWNER NAME (IF AVAILABLE): _____

BUSINESS NAME (IF APPLICABLE): _____

REASON FOR RED TAG ISSUE (BE SPECIFIC): _____

_____

_____

APPLIANCE OR EQUIPMENT FUEL TYPE(IF APPLICABLE):

___Natural Gas ___Fuel Oil ___Propane ___No Fuel (Electric) ___Other_____

ISSUING NFR UNIT: _____

ISSUED BY (TITLE/PRINT NAME): _____

OCCUPANT/OWNER SIGNATURE: _____ CONTACT NUMBER: _____

CLEARED BY: _____ DATE: _____

White - Apply to item Yellow Copy - Fire Marshal Pink Copy - Building Official

Response Procedures

- Repeat atmospheric monitoring to confirm ventilation is complete and atmospheric CO is at or below:

Residential Occupancies: 9 ppm (EPA)

Industrial/Business: 35 ppm (NFR)

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Response Procedures – No CO or Below TWA

- Leave a CO detection tube
- Brief the occupants on its use and who to call if it indicates the presence of CO
- Notify the fire prevention bureau of the placement of the CO tube
- Fire prevention will follow up with the occupants in 7 days to close out the event

Carbon Monoxide Detector Tube Cards

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MSA style Mini CO Cards

MSA USA

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Drager Pac 3500 CO Meter

Operation and Use

Drager Pac 3500

- Norfolk Fire Rescue was using the ToxiRae 3 for several years. The ToxiRae 3 parts were being phased out for a new generation of meters
- Norfolk Fire Rescue selected the Drager Pac 3500 as it's new single gas meter

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Drager Pac 3500

- Easy to use
- Will be found on Medic Units and Ladder Companies
- Compact instrument
- Virtually maintenance free
- Turn on and leave On!
- 2 year battery

- **<u>We Leave the Unit Turned ON!!!</u>**

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There are numerous models of Single gas meters available

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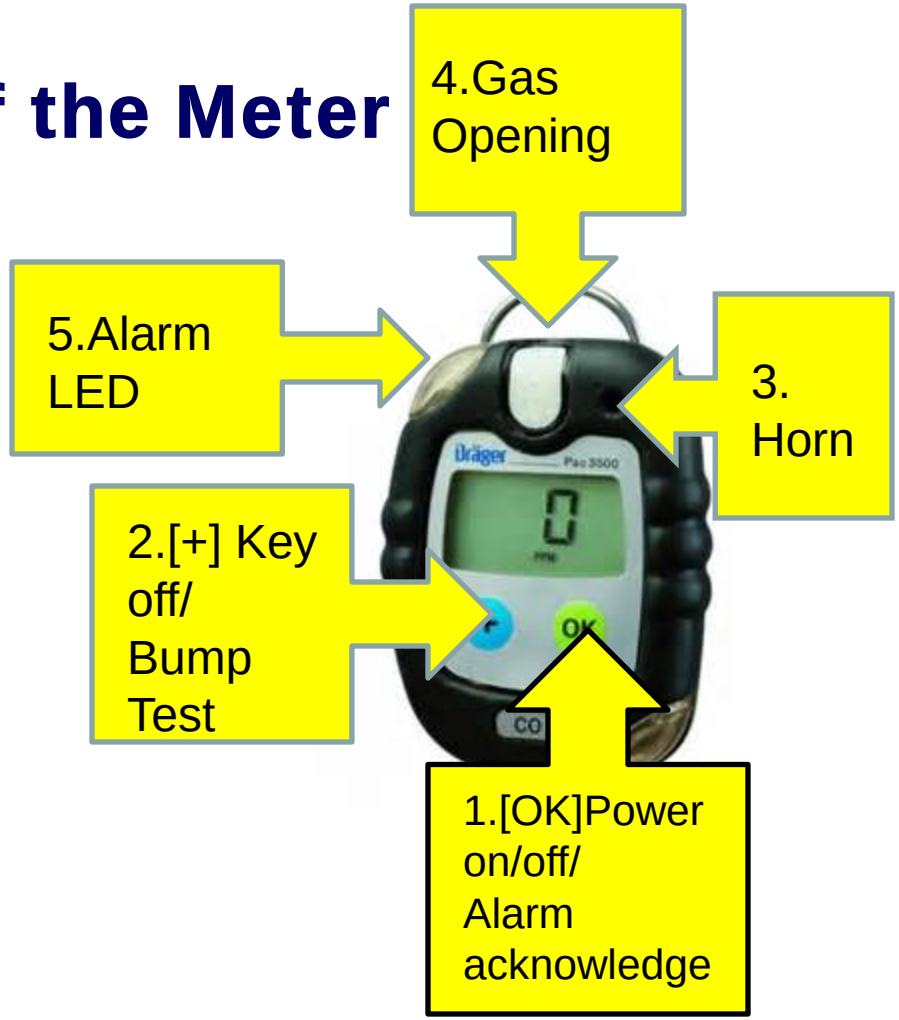
Drager Pac 3500

- **Components of the Meter**
  1. **OK Key**
  2. **+ Key**
  3. **Alarm Buzzer**
  4. **Gas Inlet**
  5. **LED Alarm**



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Drager

- **Turning the meter on**
  - **Press & hold OK key for 3 seconds**

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Drager Pac 3500

- Remaining Life of the Device

  Once activated check the remaining life by pressing [+] while device is turned off. The remaining time in days will be shown. After another press [+] “d” will be shown. Another press [+] the gas to be measured will be shown

[+] Key

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Drager Pac 3500

- To turn off the Meter

  Press and hold [OK] and [+], allow the meter to count down. Screen will go blank after 3 seconds

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Drager Pac 3500

- **Upon Startup the device will perform a self test**
- **The Number of days of remaining operation are shown. Ex “750”,”d”**
- **The A1 alarm and A2 alarm limits are shown**
- **Alarm Limits are set A1=9PPM, A2=35ppm**
- **If Unit alarms at any time Request a Rescue Company for additional monitoring!!!!!**

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Case Studies

- Norfolk Fire Rescue Program
- Established June of 2014
- Within 2 days Success story
- Over 10 Documented Cases

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Case #1

- June 2014
- Medic Only response for Sick Person
- Initial complaint Flu like symptoms
- Elderly subject in subsidized housing
- CO Alarm on medic bag prompted full Response
- Investigation revealed faulty gas stove

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Case #2

- December 2014
- Initial response for Altered Mental Status
- Engine and Medic arrived to find elderly subject with ALOC
- Initial BLS assessment and Alarm sounded
- Rescue Company responded elevated CO readings
- Source subjects using cast iron pot with water as heat source

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Case #3

- March 2015
- Commercial Structure (Restaurant)
- Dispatched as Unconscious
- Initial Pt contact EMS monitor alarmed
- Full Response
- Readings over 150 in Commercial Structure
- Utilized LUF 60 to ventilate building

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Case #4

- Norfolk Fire Rescue in Station
- Alarm kept sounding on Medic bag in Medic Unit
- FIREFIGHTER Response ?????

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Cases Continued

We have had over 10 confirmed cases of alarm activations on CO leaks since the inception of the program

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Newport News

- According to city officials, carbon monoxide detectors used by EMS crews alerted them to high levels in the home. Officials then rushed a 53-year-old female to Mary Immaculate Hospital. It's unclear if she was suffering from a stroke or from the high levels of carbon monoxide in the home
- When firefighters went back in to ventilate the mobile home, they found 55-year-old Stephen Alexander Harris dead inside. Harris appears to have died due to carbon monoxide poisoning, according to Lee

Wavy.com

NORFOLK FIRE – RESCUE

Newport News

http://wavy.com/2015/10/17/death-attributed-to-carbon-monoxide-poisoning/

NORFOLK FIRE – RESCUE

Ever have this conversation??????

NORFOLK FIRE – RESCUE

Thank you

- VDEM HMO Todd Cannon
- VDEM HMO Ray Haring
- Norfolk Fire Rescue Special Operations
- BC John Humphrey, Logistics Chief Norfolk Fire Rescue
- Dr. Richard Gasaway,PhD
- Wavy News
- Virginia Department of Fire Programs
- MSA America

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Questions????????

Contact Information

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