

Determination of Brief, Transient Hydrocarbon Exposures During Crude Oil Tank Gauging

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BUSINESS

Why Did These Oil Workers Die?


Natural causes were blamed, but the focus has shifted to hydrocarbon chemicals



A worker checks water levels and temperatures at an Encana Oil & Gas hydraulic fracturing operation outside Rifle, Colo. PHOTO: BRENNAN LINSLEY/ASSOCIATED PRESS

By **ALEXANDRA BERZON**

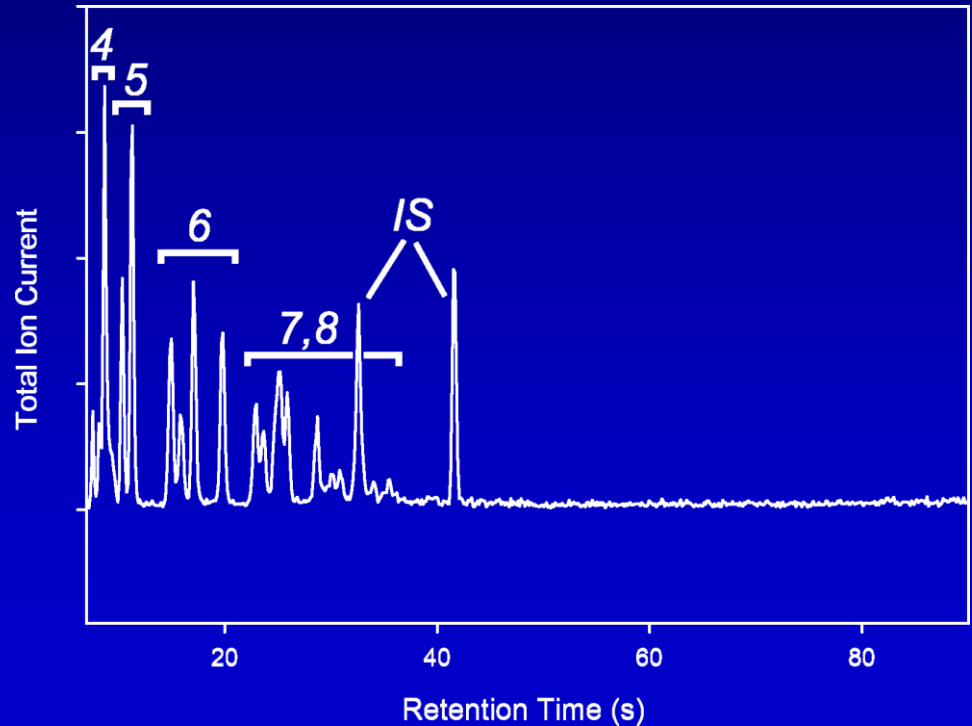
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 54 COMMENTS

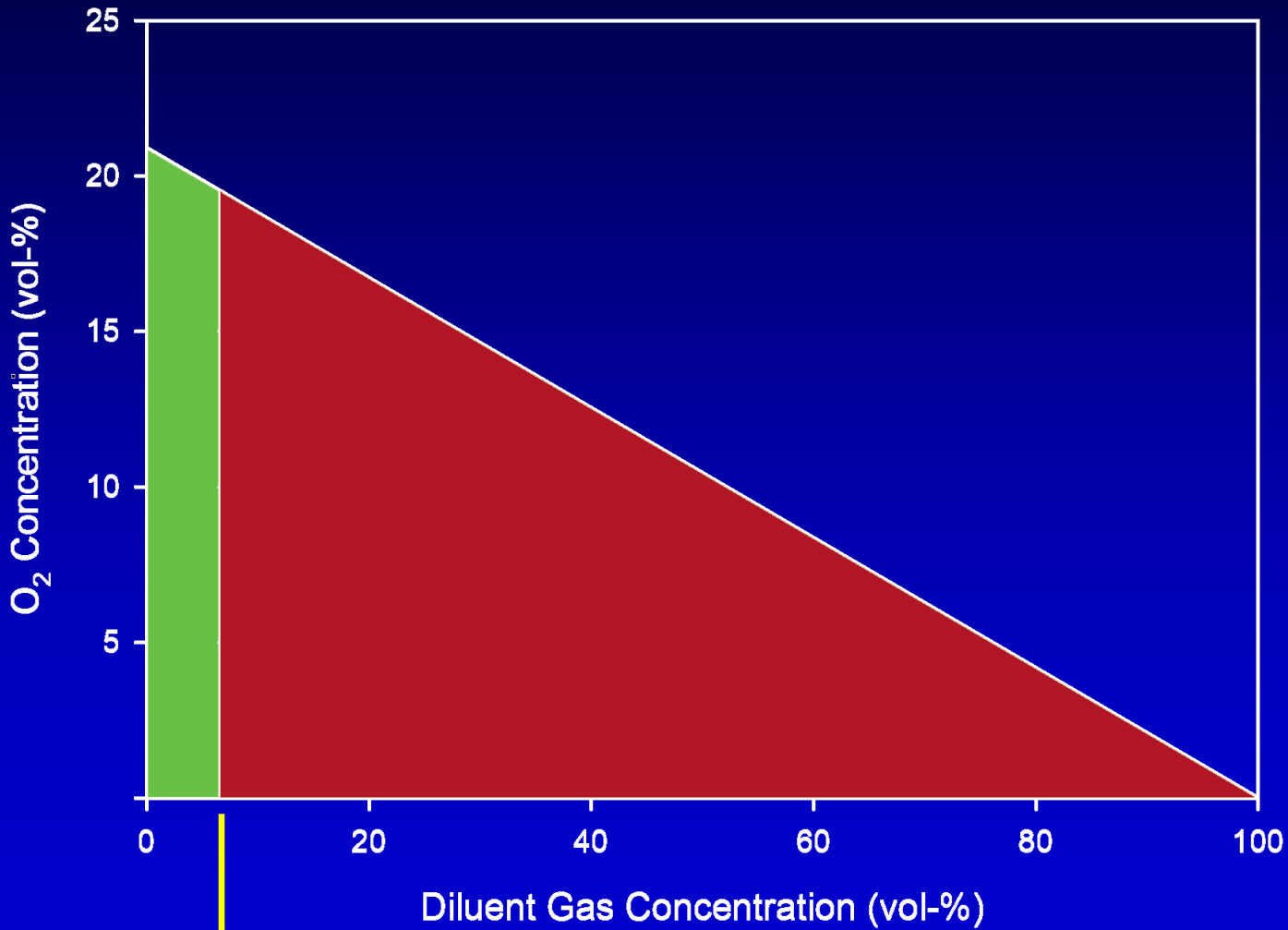


Field Analysis

To avoid the loss of light hydrocarbon gases, whole-air breathing zone samples were immediately collected onto a tri-bed needle trap for analysis by field-portable GC-MS

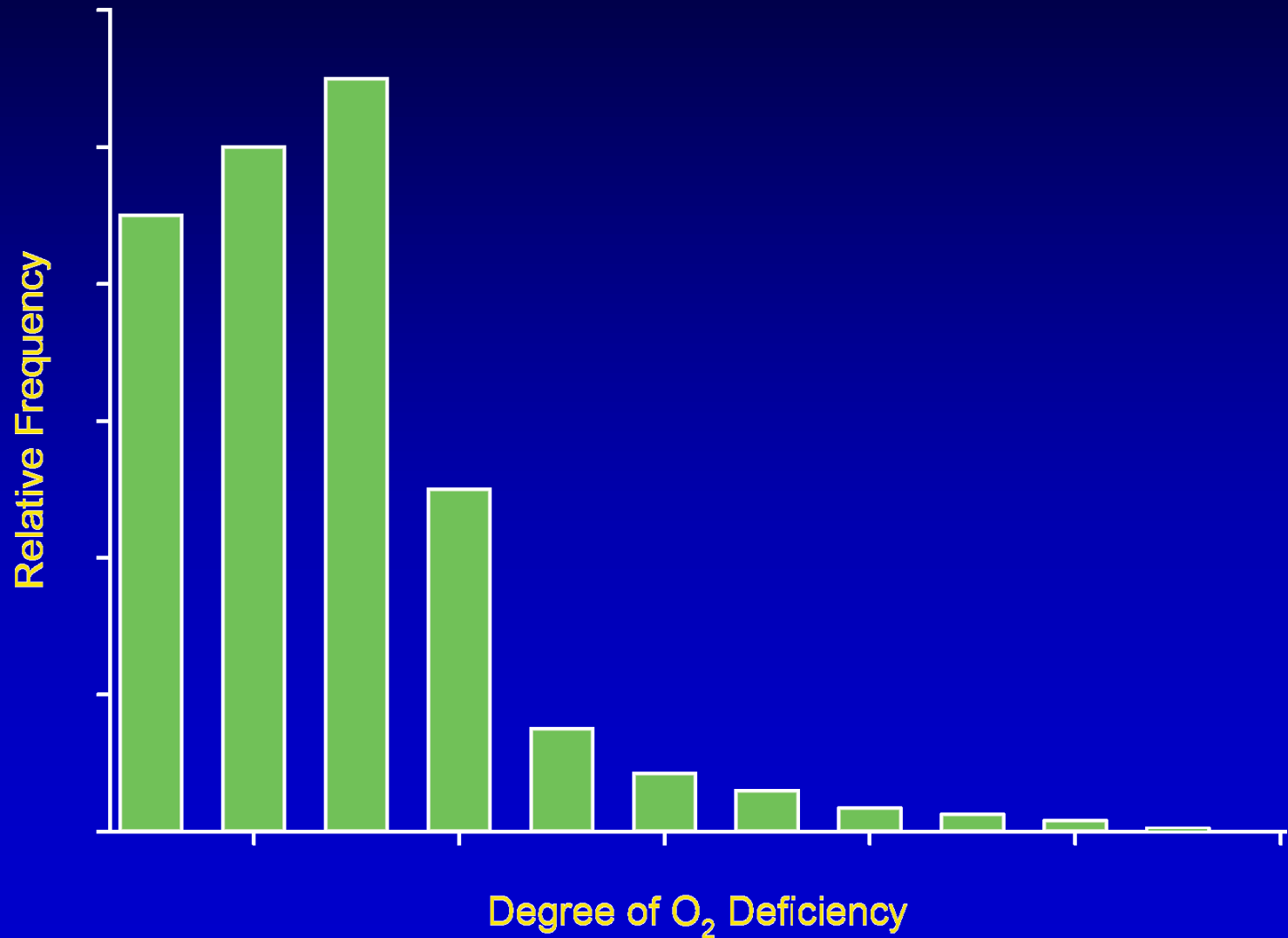


The Problem: Light Hydrocarbon Gases and Correspondingly Low O₂ Content in Tightly Sealed Crude Oil Production Tanks Have Led to a Number of Tank Gauging Deaths



6.7% Diluent Gas Concentration

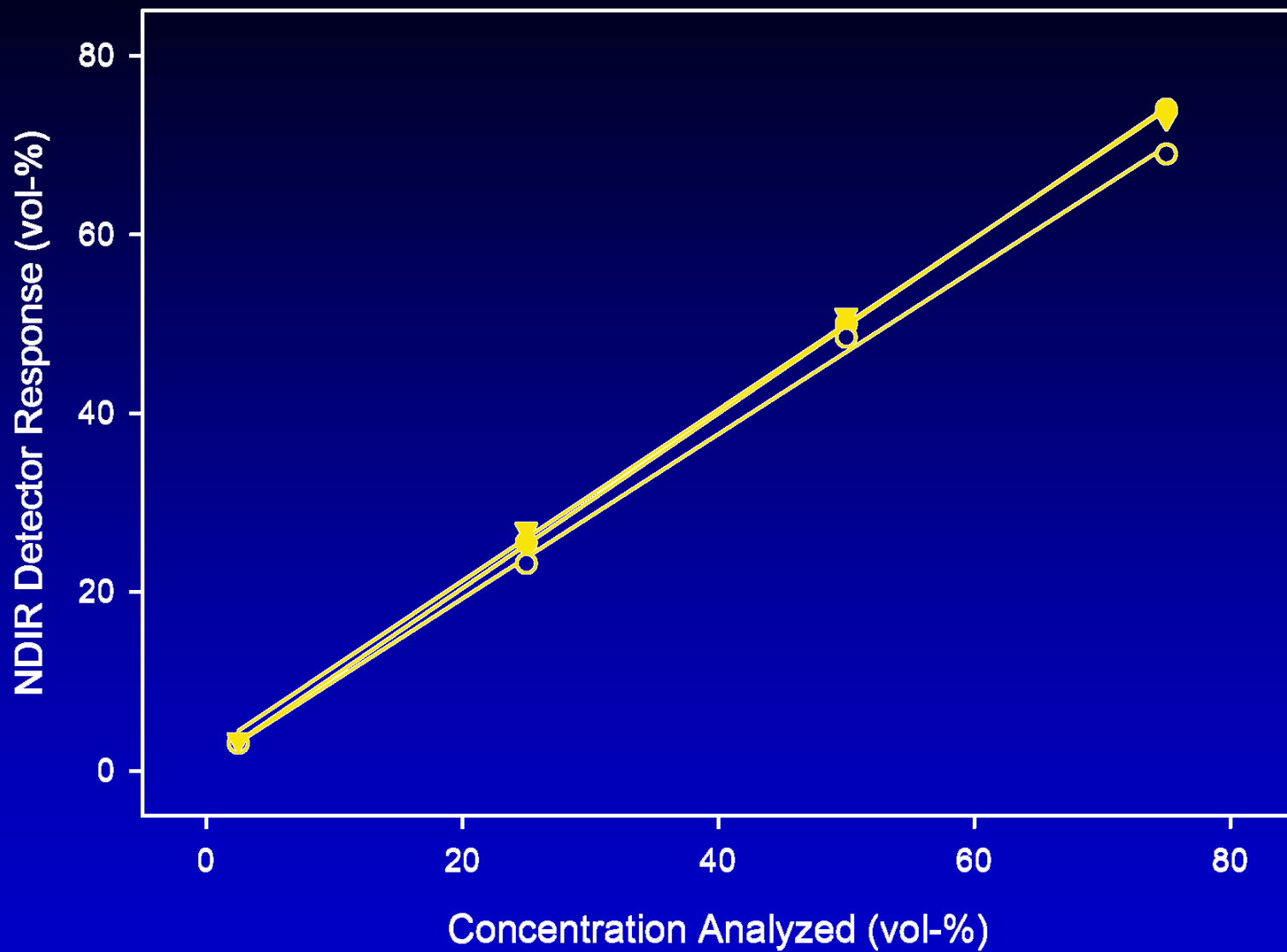
Deadly Events are Infrequent



Needed Attributes: Must detect/sample instantaneous concentrations and be simple to operate

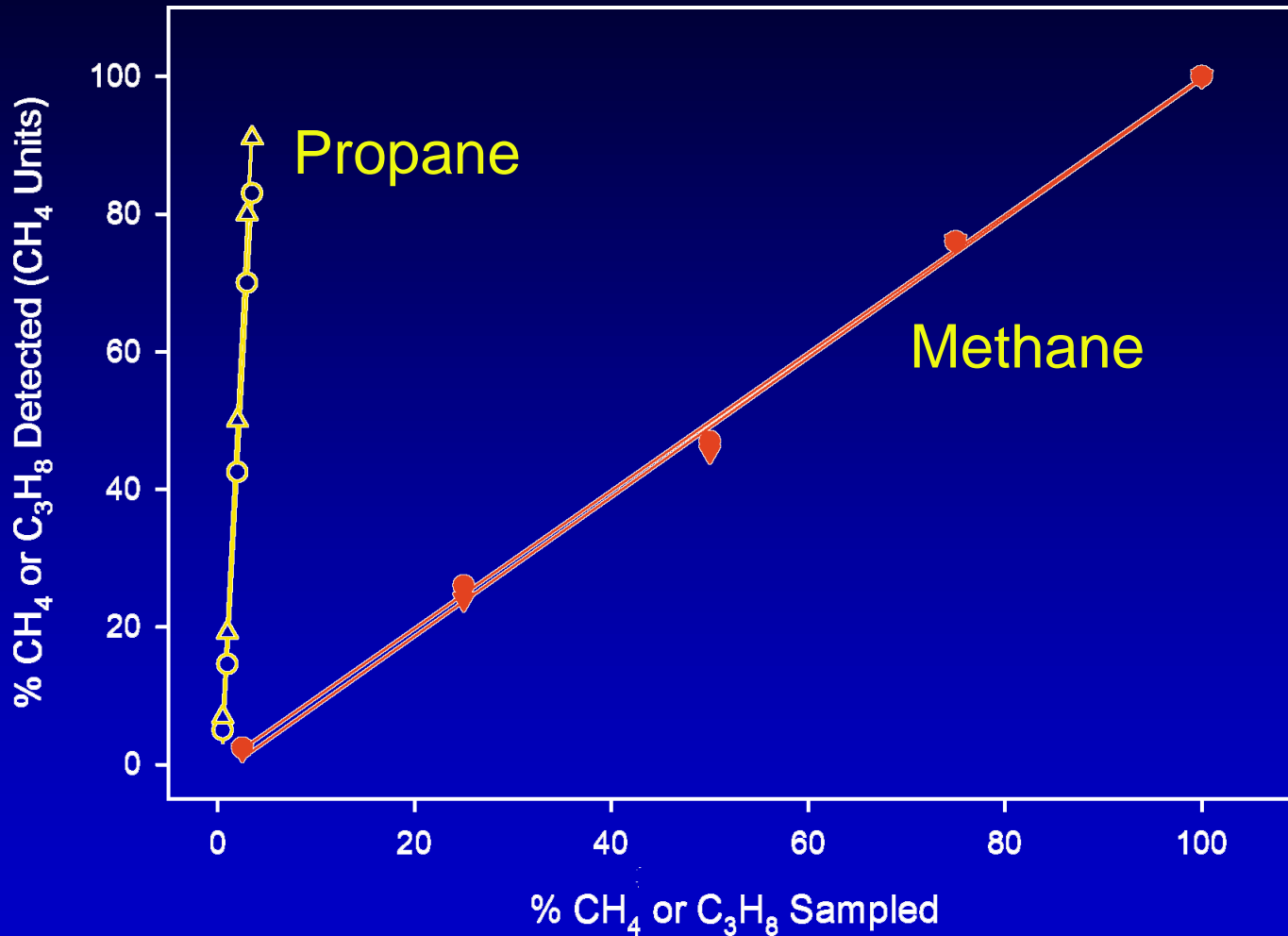
Candidate Technologies:

- (1) Integrated Direct Air Sampling with Solvent Desorption
Volatility limitations
- (2) Thermal Desorption of Sorbent
Complex TD system needed for GC analysis
- (3) Whole-air sampling
No sample concentration (not likely needed for vol-%)

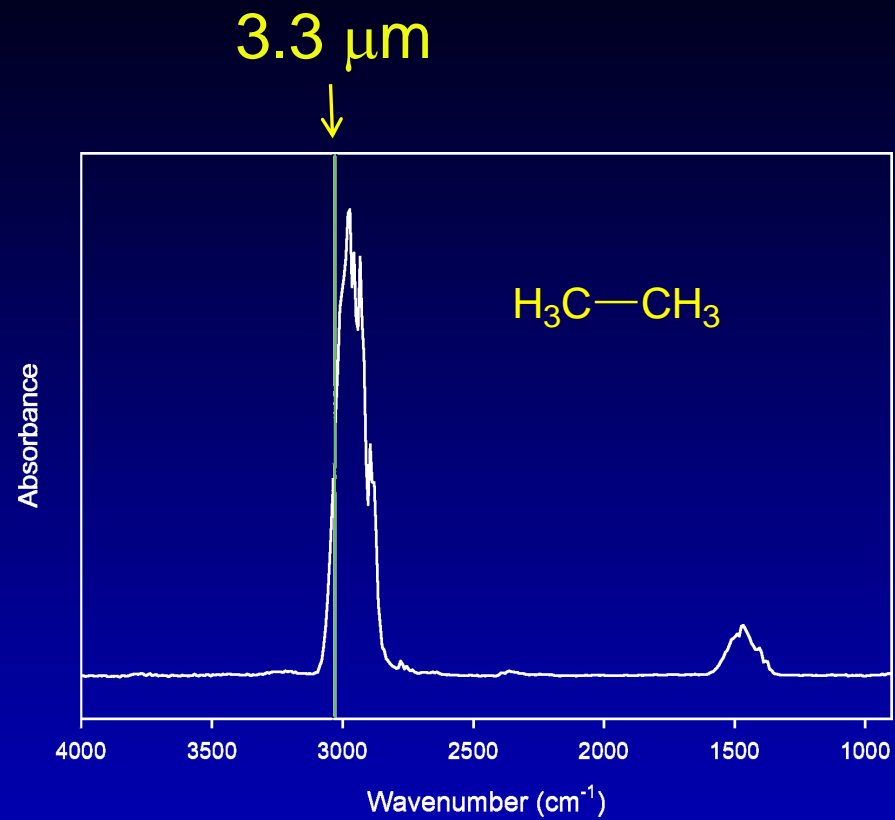
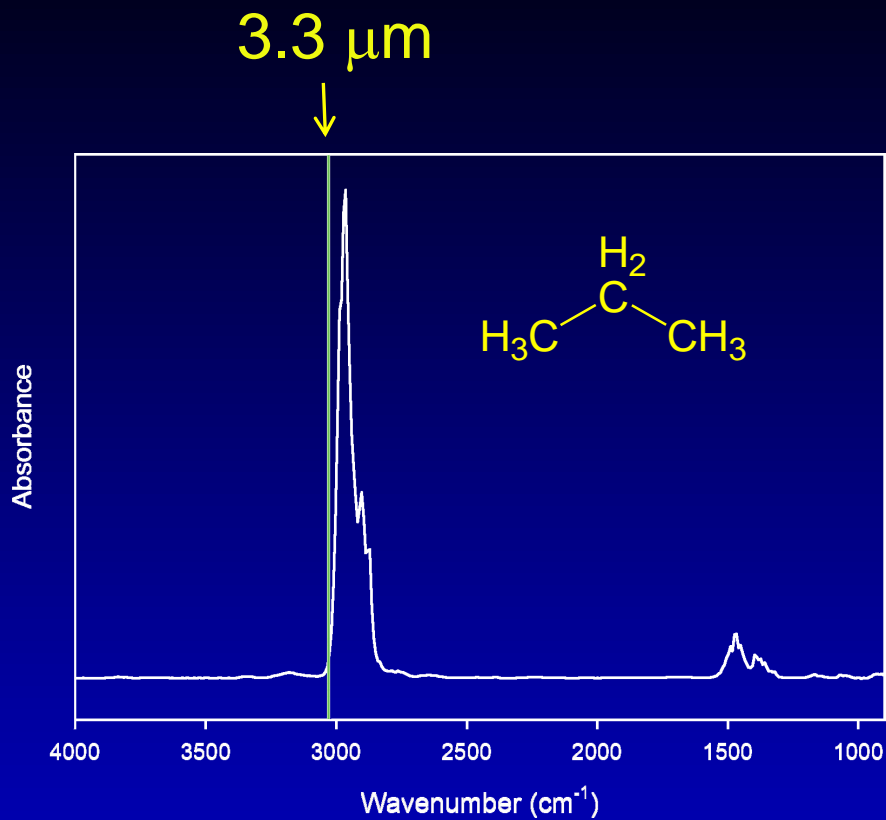


- CH4 Sampled with CH4 Calibration
- C3H8 Sampled with C3H8 Calibration
- ▼ C4H10 Sampled with C4H10 Calibration

NDIR Detection of CH₄ or C₃H₈, Calibrated using CH₄

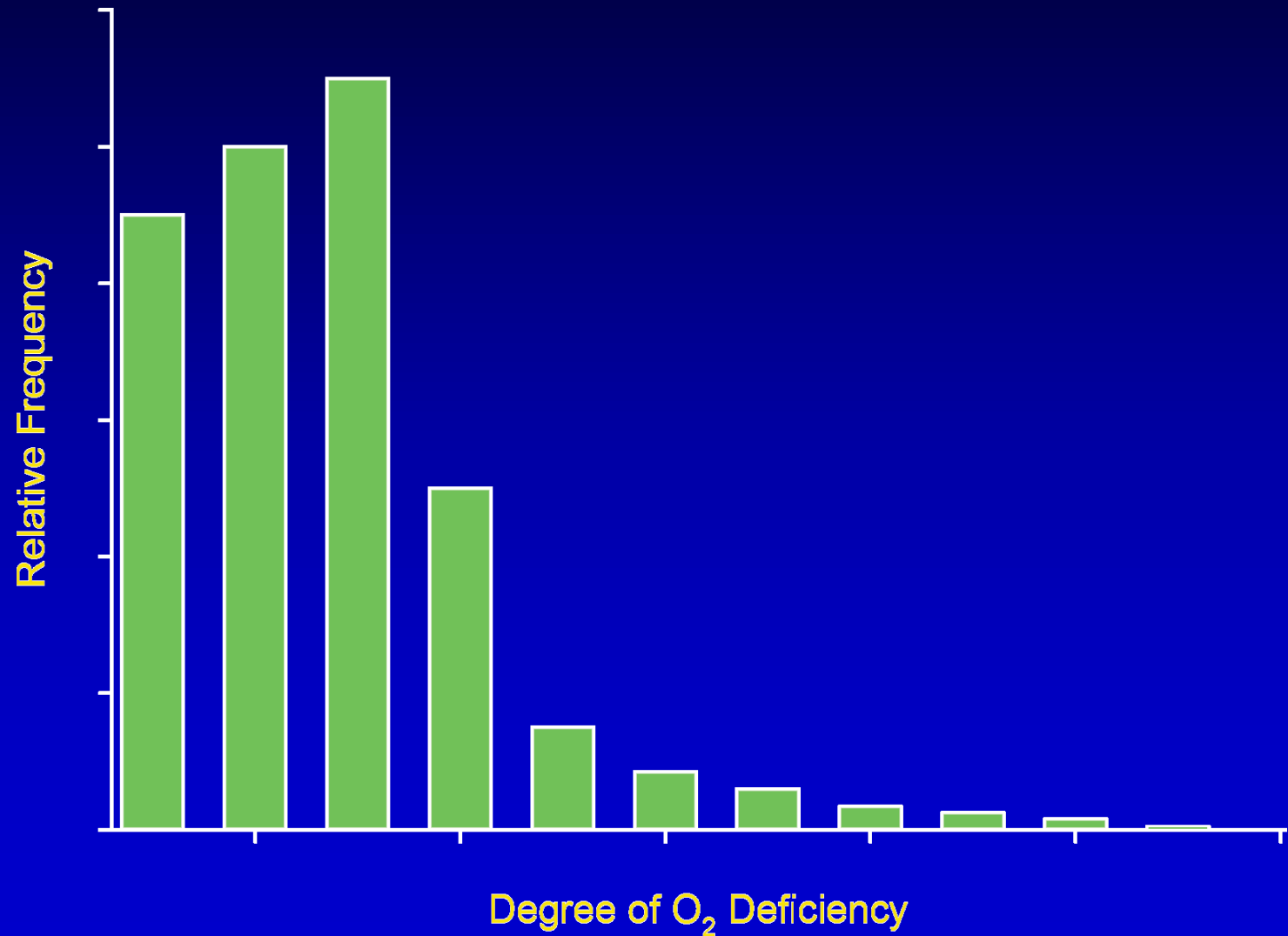


Absorbance measured at 3.3 μm (C-H stretch)
C₃H₈ molecule has more C-H bonds

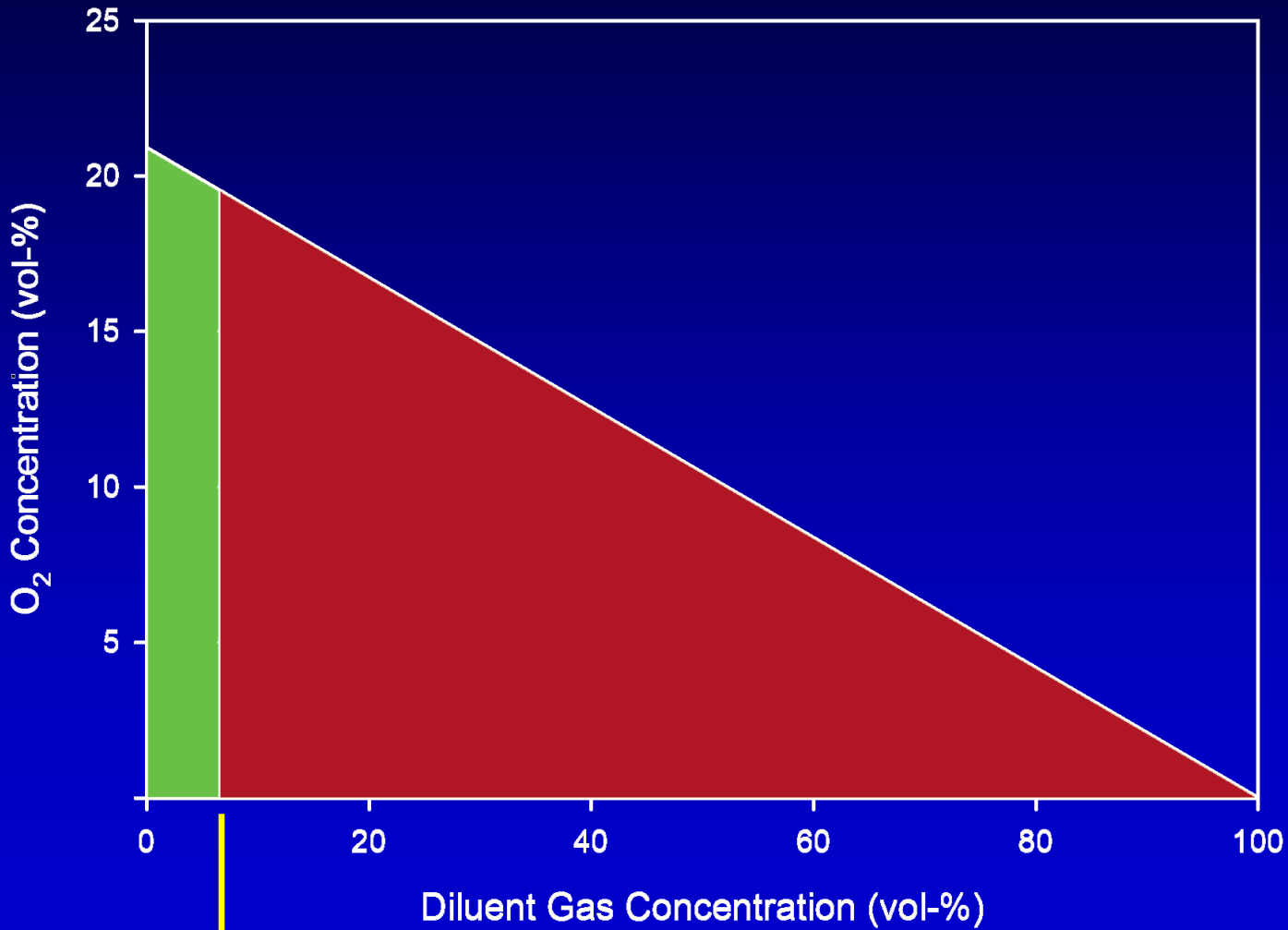


For quantitative NDIR, hydrocarbon gas identity must be known –mixtures not handled well

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Conclusions

Fatal events are possible due to low O₂, and often involve high concentrations of hydrocarbon gases

Fatal events are infrequent, suggestion lognormal exposure distribution

Numerous uncontrollable variables are involved that make prediction of outcome very difficult (impossible in some circumstances?) for uncontrolled gauging

Low O₂ or LEL sensor alarms must be treated with respect