



# Biogas Plant Case Studies



**MONTROSE**  
ENVIRONMENTAL

ABC Presentation

Case Studies

11/17/2020



# Aaron Parker P.E.

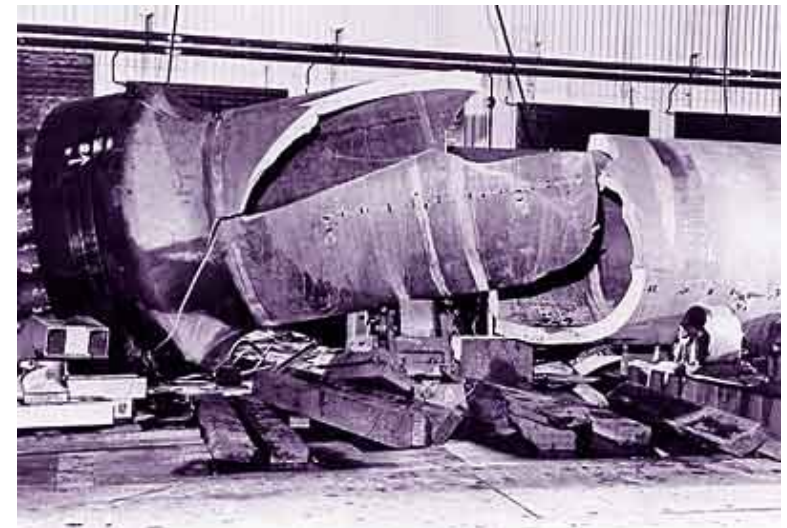
Senior Project Engineer



# Biogas Case Studies

## Improving Plant Safety and Performance

- Proper pressure safety valve size / rating / installation.
- Flare safety controls and equipment
- Material choice for corrosion prevention.



# Pressure Safety Valve Coordination

- What is a pressure safety valve and how does it work
- P&ID drawing check
- Pressure Safety Valve Coordination
- Siloxane vessels only rated for 80 psig in a system rated for 100 psig and not protected by a PSV
- Oil Coolers are not rated for system pressure
- Incorrect PSV installed on compressor



# Pressure Safety Checks

- More Pressure Safety Valve Coordination
- System has “burped” raw landfill gas into the building
- PSV vents near building fresh air inlet
- Inlet separator for compressors is only rated for 8 psig and could easily be over pressurized by recirculated gas
- Inlet and Outlet piping considerations



# High Pressure to Low Pressure Transitions

- Often seen in system drain
- Ways to mitigate the issue
- Media bed support



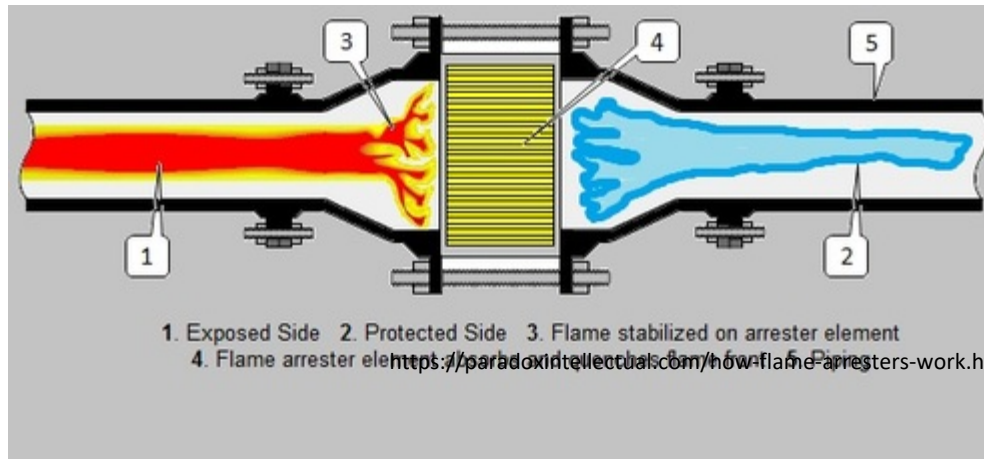
# Flame Arrestor

- How do they work
- Where to install
- How do they fail
- Other Safety Controls

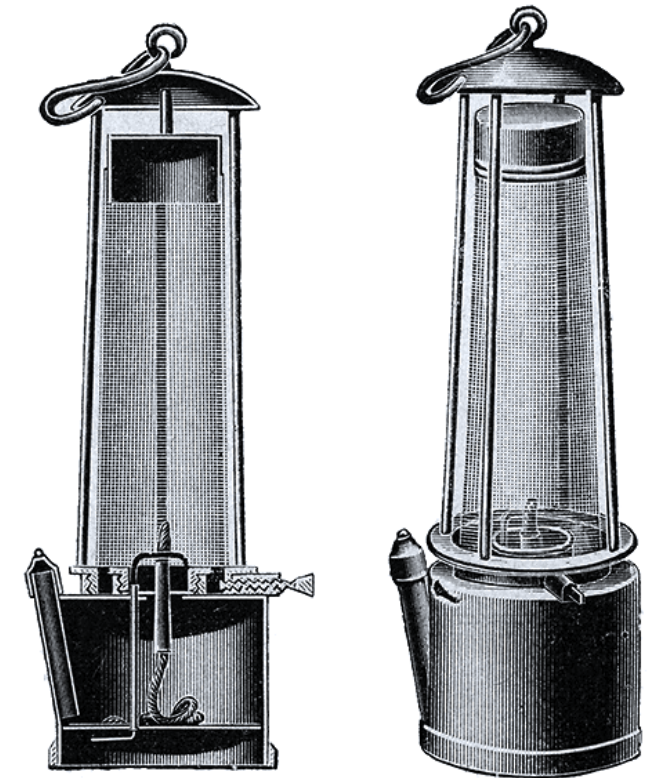


# Flame Arrestors

How do they work



<https://paradoxintellectuals.com/how-flame-arresters-work.html>



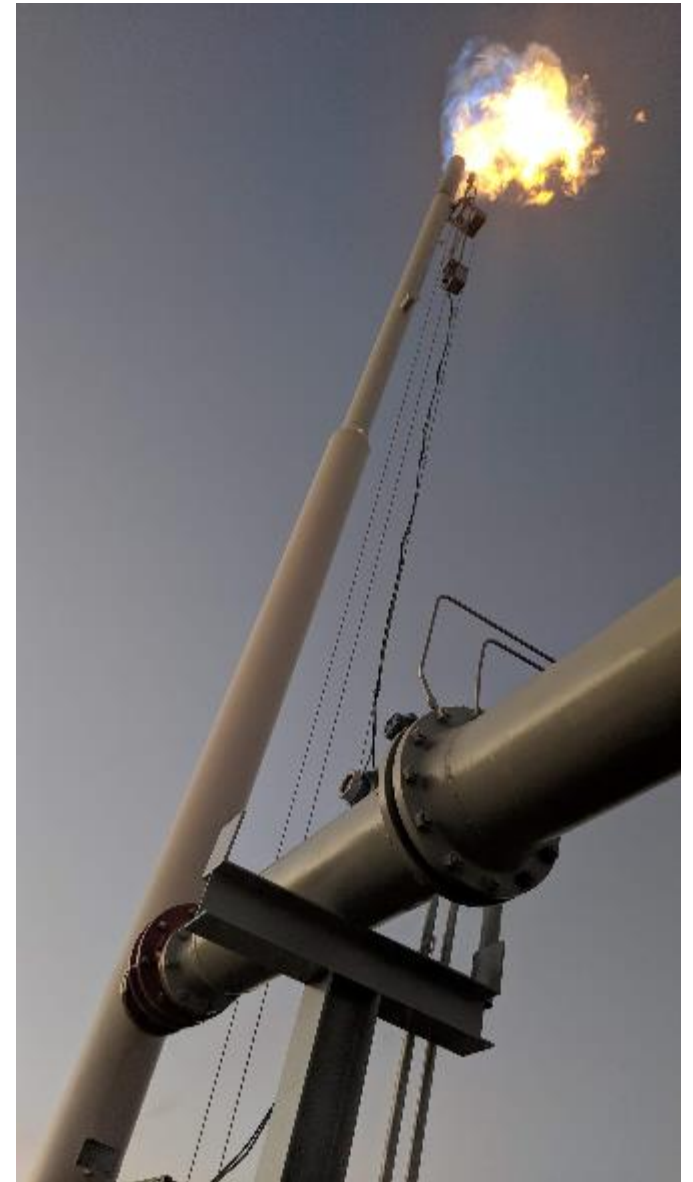
Bibliothek allgemeinen und praktischen Wissens für Militärärzte Band III, 1905 / Deutsches Verlagshaus Bong & Co Berlin \* Leipzig \* Wien \* Stuttgart





# Flame Arrestors

Where to install



# Flame Arrestors

## Failure Prevention



# Process Considerations

## Siloxane Removal PSA

- PSA process using air
- Vessels went through the LEL and UEL
- LEL and UEL for Methane is 5% to 17%



# Flare Safety Controls

- Multiple system failures
- Leaking Valve
- High Surface temps
- Corrosion
- Inadequate purge ventilation
- Controls with proved closed valves



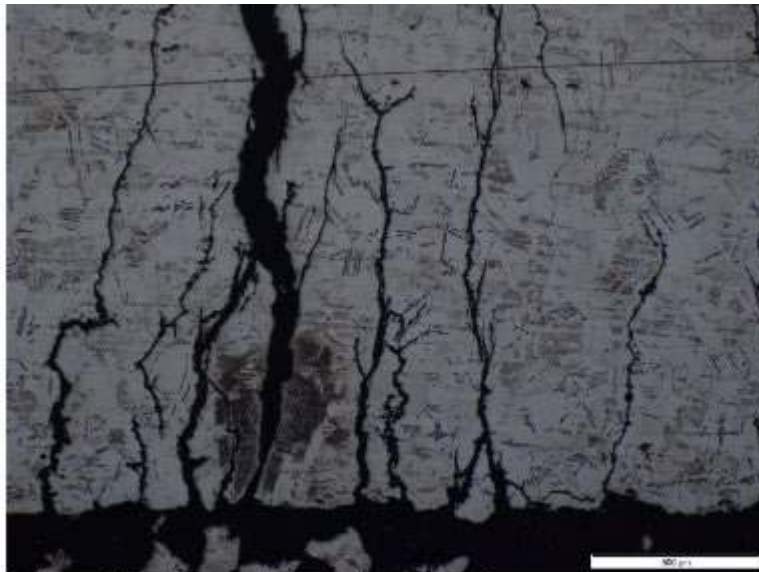
# National Fire Protection Association (NFPA)

- NFPA 86 Standard for Ovens and Furnaces
- Damper Controls / Alarms (8.6.2)
- Mechanical Ventilation (11.6.1.6 / 11.6.1.10)
- Dual safety shutoff valves in series (10.2.3.1)
- Visual indicators on shutoff valves (10.2.3.5)
- Interlock with shutoff valve and preignition system (10.2.3.7)



# Corrosion Failures

- Types of corrosion
- Where in the process
- Ways to mitigate

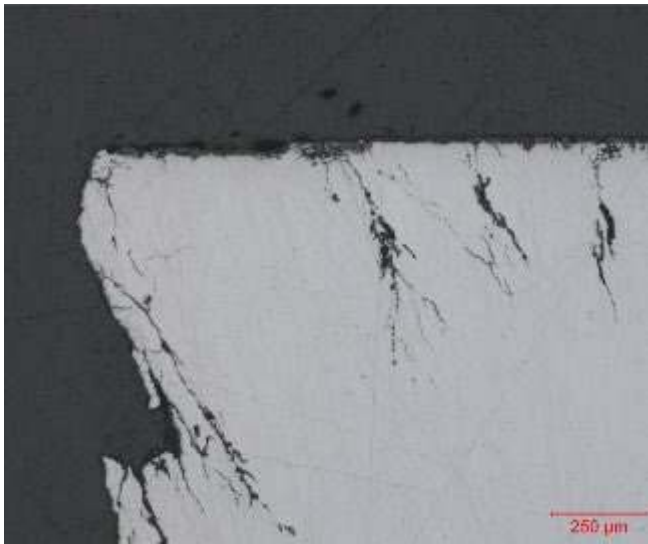


50x image of the main crack and network of secondary cracks.



# Types of Corrosion

- H<sub>2</sub>S Corrosion
- Galvanic Corrosion
- Chloride Strees Corrosion Cracking



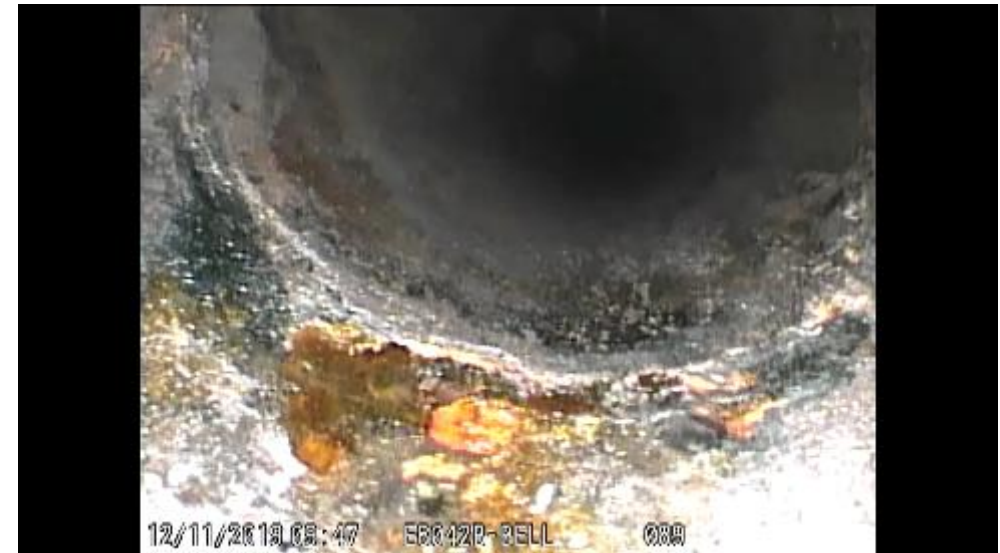
# Corrosion Examples





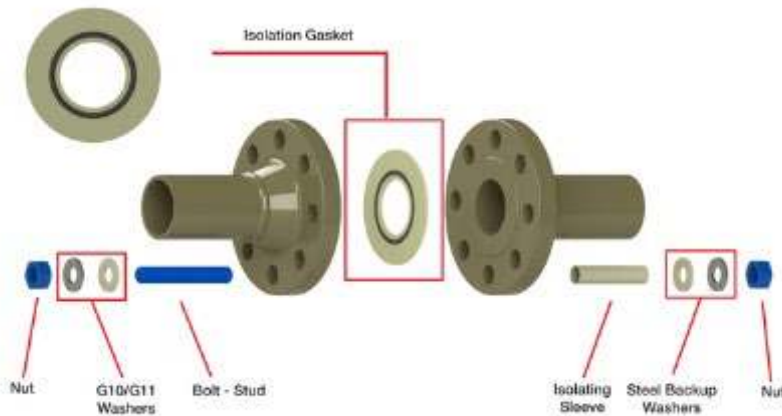
# Corrosion Mitigation

- Material Choice
  - HDPE
  - PVC
  - Carbon Steel
  - Stainless Steel 304 & 316
  - Duplex Stainless Steels
  - Nickel Alloys



# Galvanic Isolation

- Dissimilar Metals
- Dielectric Union / Isolation Gaskets



From <https://apsonline.com/flange-isolating-gasket-kits/>

