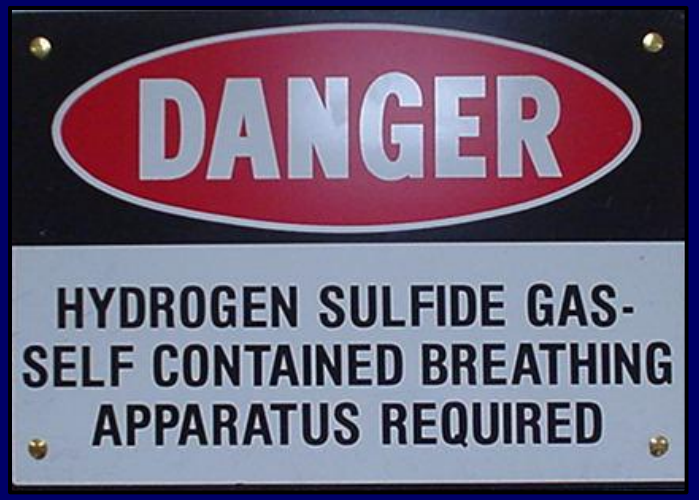
Hydrogen Sulfide Monitoring and Safety

H2S



Nova Safety & Environmental

Midland, Texas

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Course Objective

- To prepare employees for the hazards of working around H2S and how to properly protect themselves in an H2S Environment.

Class Topics

- General Properties
- Irritant
- Toxicity
- Exposure Limits
- Symptoms of Exposure
- Flammability
- Corrosiveness
- Monitoring
- Rescue
- Respiratory Protection

General Properties

- Invisible
- Flammable
- Explosive
- Toxic
- Odor of Rotten Eggs
- Corrosive
- Water and Oil Soluble
- Heavier than Air

H2S is an Irritant

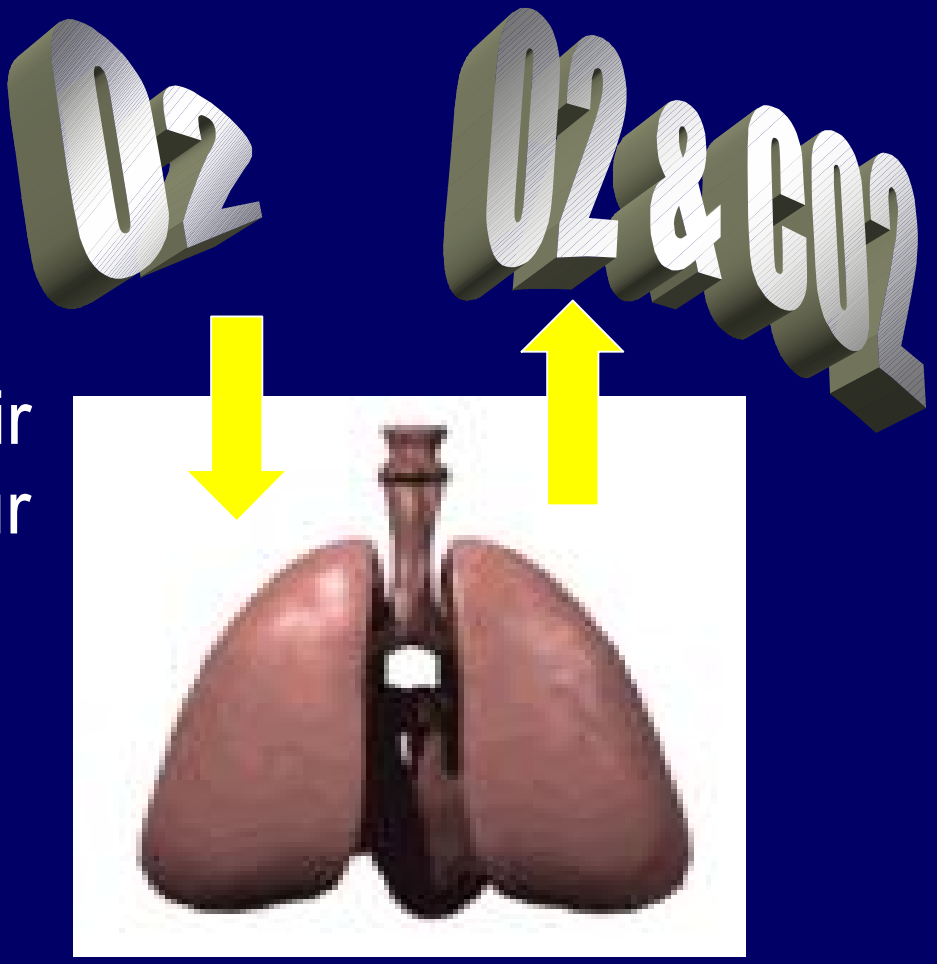
- When H2S mixes with water it forms a weak acid.
- There's water in our eyes, nose, throat and respiratory system which leads to irritation.
- Examples: burning eyes, sore/scratchy throat, coughing, respiratory irritation.

Toxicity

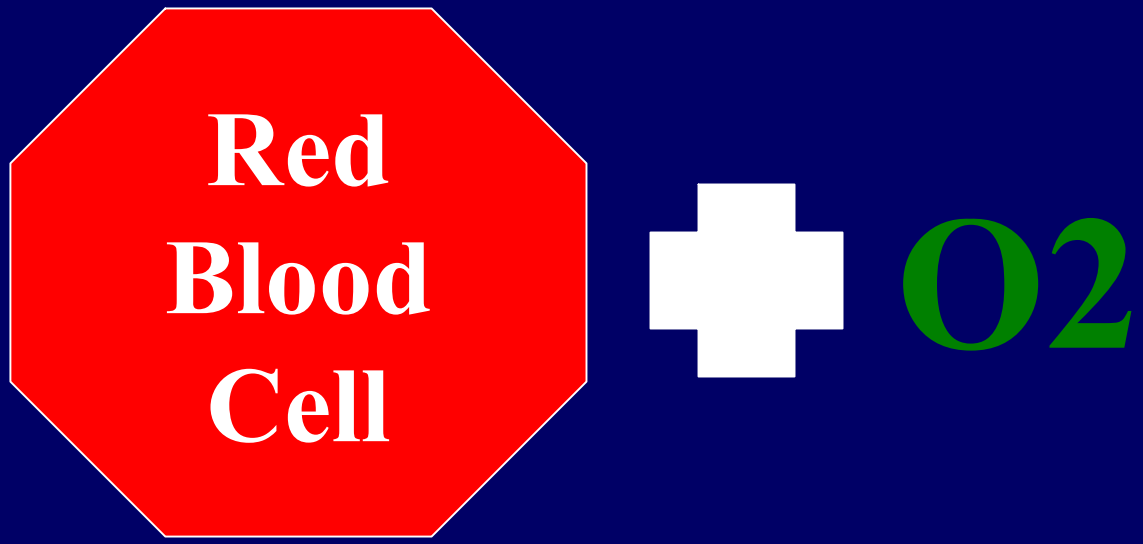
- Hydrogen Sulfide Gas is trying to kill you in three different ways!

Toxicity

- We breath in Oxygen and a gas exchange takes place through the air sacks (alveoli) in our lungs.
- We then breath out some O2 and CO2.

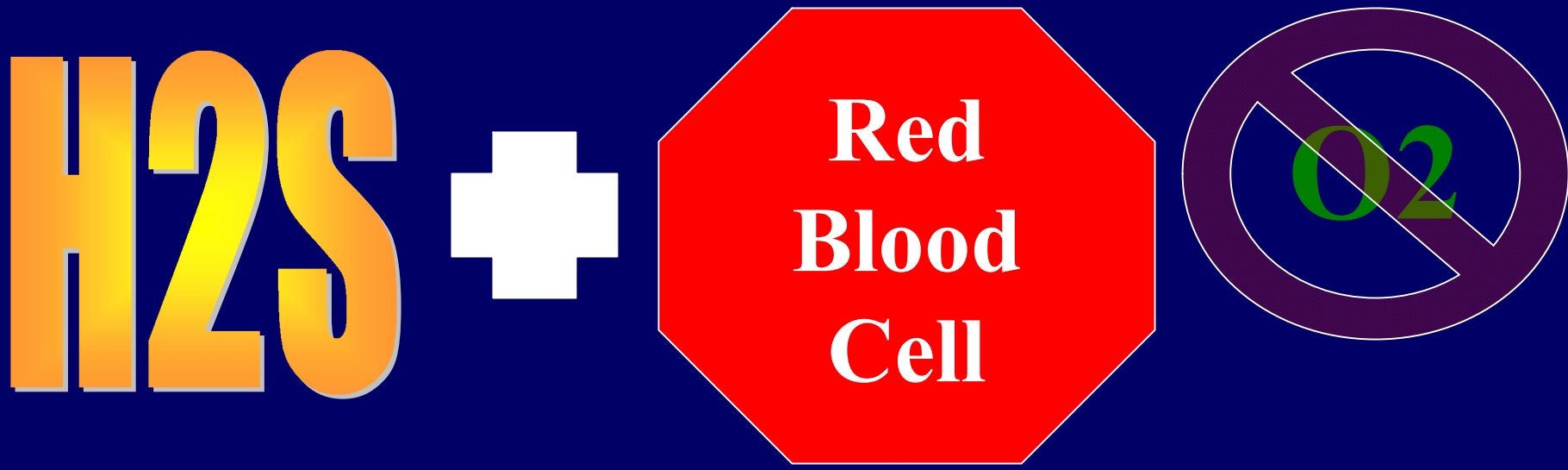


Toxicity



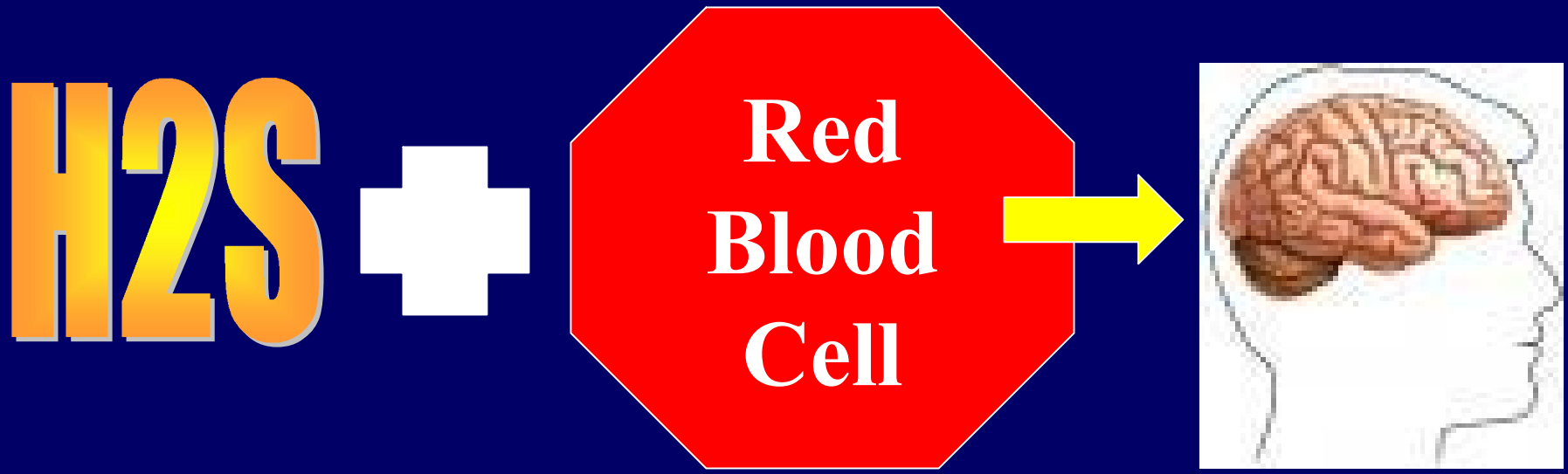
Oxygen is absorbed into the blood and then transported by the Red Blood Cells.

Toxicity



H2S blocks Oxygen from bonding to your Red Blood Cells causing Oxygen Deprivation.

Toxicity



H2S is also transported to the brain by the Red Blood Cells.

Toxicity

- Once H2S is in the brain, it attacks the Respiratory Control Center.
- H2S seeks to shut down respiratory system or…
- Slow it down at lower concentrations and…
- It deadens your sense of smell!
- Never trust your nose to detect H2S.

Toxicity

H2S + H2O

=

WEAK ACID

H2S mixes with the water in our lungs forming a weak acid.

Toxicity

- Weak acid in the lungs attacks the alveoli.
- Alveoli blister and burst.
- Victim aspirates on own blood and puss, also known as Pulmonary Edema.

Exposure Limits

- P.E.L. = Permissible Exposure Limit
- Defined as the maximum air concentration you can be exposed to in an 8 hour period, 40 Hour Week, without respiratory protection.
- Established by O.S.H.A., making it a LAW.

Exposure Limits

The P.E.L. for H2S is 10 ppm.

ppm stands for parts per million

Exposure Limits

- I.D.L.H. = Immediately Dangerous to Life and Health.
- I.D.L.H. H2S = 100 ppm
- S.T.E.L. = Short Term Exposure Limit, based on a 15 Minute Time Period
- S.T.E.L. H2S = 15 ppm

Exposure Limits

Immediate Death Level

1000 ppm

Knocked out immediately, death in 3-5 minutes.

Symptoms of Exposure

- These are your last line of defense.
- Commit these to memory.
- You may not experience each one of these as everyone's physiology is different.

Symptoms of Exposure

- Burning Eyes
- Sore Throat
- Respiratory Irritation
- Coughing
- Headache
- Dizziness
- Nausea
- Fatigue
- Confusion
- Loss of Sense of Smell

Flammability

- H2S is a highly flammable and explosive gas.
- H2S fires produce a toxic gas.

Flammability Range

Over 46% = Too Rich to Burn

U.E.L. H2S = 46% or 460,000 ppm

Ignition Temperature is 500*F

L.E.L. H2S = 4.3% or 43,000 ppm

Below 4.3% = Too Lean to Burn

Sulfur Dioxide

- The main byproduct of an H2S fire is Sulfur Dioxide or SO2.
- P.E.L. SO2 = 2 ppm
- I.D.L.H. SO2 = 20 ppm

Sulfur Dioxide

- Sulfur Dioxide is highly toxic.
- It is water soluble and forms a weak sulfuric acid when mixed with water.
- It can suffocate it's victims.
- It will also burn up your lungs from the inside by forming acid and destroying the alveoli.

Corrosiveness

- H2S corrodes carbon steel readily.
- The oxidization (rusting) on the surface of the metal forms Iron Sulfide Scale, or black scale.
- Iron Sulfide Scale is pyrophoric.

Iron Sulfide Scale

- Iron Sulfide will flash as it dries and is exposed to air.
- This can be a serious hazard when working on pipelines, flow lines, tanks and the like.

Corrosiveness

- H2S weakens Carbon Steel causing it to become brittle and break.
- Why or where would this be a hazard in the field?

Monitoring

- Two types of monitoring:

1. Personal Monitors
2. Fixed Monitors

Personal Monitors

- Small and Convenient
- Easy to Use
- Monthly Bump Checks
- Yearly Calibration

Personal Monitors

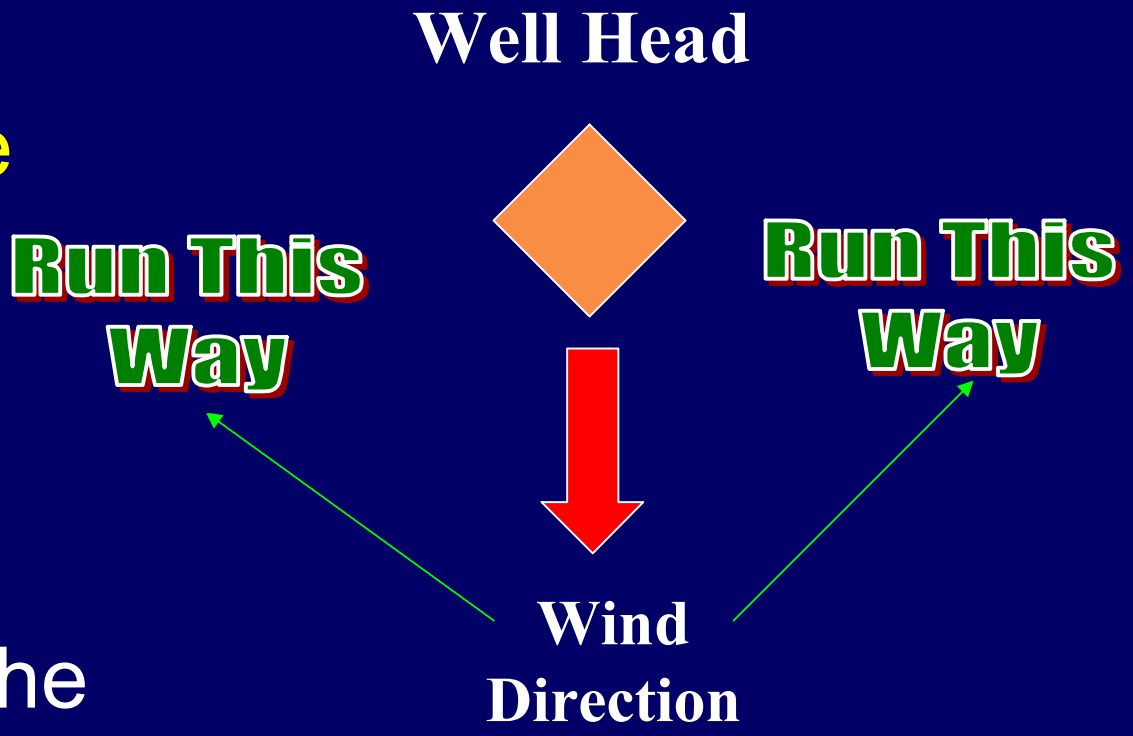
- Wear on your hip.
- Keep the Sensor Head exposed.
- Alarms will sound at 10 ppm, why?
- Alarms can be sounds, lights, vibration or any combination of the three.
- Take care of your monitor!

Fixed Monitors

- Found on Rigs, Well Sites, Refineries, Storage Facilities, etc…
- Sound at the P.E.L.
- Alarm usually consists of light as well.
- TRUST the fixed alarms! When monitors go off, leave and move to the safe area immediately.

Stay Wind Smart

- Always pay attention to the flags or wind socks.
- When alarms sound, retreat cross wind to the safe briefing area.



Rescue

- H2S kills many of us when we don't think, or aren't trained, and we attempt a rescue.

- Remember, always protect yourself first, then assist any victims in an H2S emergency.

In Order to Rescue:

- You must be rescue trained,
- Use the Buddy System,
- You must be CPR & 1st Aid Trained,
- You must be trained for the specific environment, in this case, an H2S environment,

In Order to Rescue:

- You must use the correct Personal Protective Equipment (P.P.E.),
- Maintain good communication with other rescuers and off site personnel,
- Notification of E.M.S.,
- and follow your Emergency Action Plan

Rescue

- If you do rescue of victim of H2S, be careful when providing rescue breathing.
- Above all else, follow your company's policy on rescue.
- Never, ever, rescue unless you can do so the right way!

Respiratory Protection

- The only type of Respiratory Protection allowed in an H2S Environment is:

Positive Pressure Supplied Air

Positive Pressure Supplied Air

- Constant Flow of Air in Mask.
- Pushes Air out of Leaks instead of letting you pull toxic gasses in.
- Not filled with pure oxygen, but Grade “D” air.

3 Types of Respirators for H2S Environment

- Escape Pack:
- 5 Minute Tank
- Bag or Tight Fitting Face Piece
- Not for Rescue, Work or Testing!

Escape Unit

3 Types of Respirators for H2S Environment

- Work Unit:
- Also called a Supplied Air Respirator or S.A.R.
- 5 Minute Escape Tank
- Mask
- Up to 300’ of Line supplying the user with air
- Tied into a cascade or compressor

Air Line Unit

3 Types of Respirators for H2S Environment

- Rescue/Testing – S.C.B.A.:
- Self Contained Breathing Apparatus
- Mask, harness and 2216 psi Tank
- Always turn valves away from you to get more air.
- Will a 30 minute air pack last 30 minutes?
- No – A 30 minute air pack will not last 30 minutes.

Self Contained Breathing Apparatus

Respiratory Protection

- Check out your equipment and make sure that it is properly maintained.
- Only use Positive Pressure Supplied Air in H2S environments.
- Fit testing is required yearly by O.S.H.A.
- No facial hair other than a neatly trimmed mustache.

Respiratory Protection

- Fit Testing is done to ensure that your respirator will work when it counts.
- There are two type of Fit Tests:
- Qualitative Fit Testing checks the quality using a smoke or odorant
- Quantitative Fit Testing assigns a numerical Fit Factor using a pump system and computer.

Respiratory Protection

- Fit Tests require that a Medical Exam or M.E.Q. be completed prior to the first test,
- Or after any major changes in physiology or a serious illness.
- M.E.Q. is a questionnaire filled out by the employee and reviewed by a P.L.H.C.P.

Things that make a fit test fail?

- Facial Hair
- Glasses
- Mask Size or Type
- Jewelry
- Grease or Dirt
- Facial Structure

Remember that your company is responsible for providing you with a mask that fits, but it's your responsibility to maintain the condition of the mask and avoid any facial hair or other issues that may interfere with the fit of your mask.

Training Issues

- Quality of training.
- Employee attitude.
- Management attitude.
- Bi-Lingual Training.

Any Questions?

Thank You!

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