Hydrogen Sulphide (H2S) & Escape Breathing Apparatus (BA)

Aim

To enhance the employees' understanding the Hydrogen Sulphide gas (H2S) as a hazard associated within the framework of ADCO's Procedure and knowledge on the use of respiratory protection equipment during an H2S emergency.

Course Agenda

- **Emergency Procedures**
- **Course Rules**
- **Course Outline**

Emergency Procedures

- **Be Aware**
- **Emergency Exits**
- **Fire Alarm**

Course Rules

- **Mobile Phone usage (please be courteous)**
- **Breaks**
- **Participation**

- **No sleeping during the course**

Course Objectives

- **Assess the consequences of H2S hazard.**
- **Know the methodology of H2S gas monitoring**
- **Understand ADCO Procedures in handling H2S**
- **Understand ADCO emergency procedures**
- **Demonstrate understanding on use of Hooded Type Escape Sets.**

Course Outline

1. 2009 Shah Incident
2. What is Hydrogen Sulphide (H2S)?
3. Effects of H2S
4. Protection Against H2S
5. Breathing Apparatus
6. ADCO Facial Hair Policy
7. H2S in ADCO
8. Summary
9. Assessment

ADCO HS&E Policy

ADCO Health, Safety and Environment Policy

ADCO is fully committed to the principle of sustainability. This encompasses prevention of incidents, injuries, occupational illnesses to its employees, contractors and members of the public. ADCO is equally committed to the prevention of pollution, protection of the environment and conservation of natural resources.

To achieve this, ADCO will:-

- Integrate Sustainability into its Management Practices.
- Uphold Health, Safety and Environment (HSE) as core-values in all its activities.
- Comply with all applicable U.A.E., Abu Dhabi laws, regulations, ADNOC Codes of Practice and apply international standards and HSE best practices as appropriate.
- Design and maintain plant & equipment and develop safe operating systems & methods of work in order to ensure safe and healthy work places.
- Use best available environmental technology and practices to progressively reduce emissions, discharges and wastes, improve the efficient use of energy and conserve natural resources
- Protect terrestrial and marine biodiversity in its operational areas.
- Identify HSE risks and minimize them to a level As Low As Reasonably Practicable (ALARP) to ensure safety of people, protection of the environment and integrity of operation.
- Hold all levels of management, supervisors, and employees accountable for HSE performance.
- Empower all employees and contractors to stop any work that is considered unsafe or not in line with HSE policy and procedures.
- Correct all HSE deficiencies and non-conformances identified through audits, inspections and incident investigations as well as other sources, in a timely manner.
- Continually improve HSE performance by fostering a positive HSE culture that recognises individual contributions.
- Measure, appraise and publicly report Sustainability Performance.

سياسة الصحة والسلامة والبيئة لدى أدكو

تلتزم شركة ادكو بشكل تام بمبادئ الاستدامة، ويتضمن هذا الالتزام منع وقوع الحوادث والإصابات والأمراض المهنية لموظفيها ومقاوليها وأفراد المجتمع وفي الوقت نفسه المحافظة على المصادر الطبيعية وحماية البيئة ومنع تلوثها.

لتحقيق ذلك ستعمل ادكو على:.

- دمج مبدأ الاستدامة في ممارسات الإدارة.
- اعتماد مبادئ الصحة والسلامة والبيئة قيما أساسية في كافة نشاطات الشركة.
- الالتزام بكافة القوانين والتشريعات السارية في دولة الإمارات العربية المتحدة وفي إمارة أبو ظبي و أصول الممارسات المهنية لأدنوك وتطبيق المناسب من المعايير الدولية وأفضل الممارسات في مجال الصحة والسلامة والبيئة.
- تصميم وصيانة المنشئات والمعدات وكذلك إعداد وتطوير نظم وطرق تشغيل آمنة وذلك لتأمين بيئة عمل صحية.
- استخدام أفضل التقنيات والممارسات البيئية للسعي المتواصل لخفض الانبعاثات والنفايات وتحسين سبل الاستخدام الأمثل للطاقة مع المحافظة على الموارد الطبيعية.
- حماية التنوع الحيوي في مواقع عملياتها البرية والبحرية.
- تحديد المخاطر المتعلقة بالصحة والسلامة والبيئة وتخفيض درجة خطورتها لمستوى مثالي وعملي لضمان حماية الأفراد والبيئة وسلامة العمليات.
- إلزام الإدارة بكافة مستوياتها والمشرفين والعاملين في الشركة بتحمل مسؤولية اداء الصحة والسلامة والبيئة.
- منح جميع موظفي الشركة ومقاوليها صلاحية إيقاف أي عمل يعتبر غير آمن أو ينافي سياسة وإجراءات الصحة والسلامة والبيئة المطبقة لدى الشركة.
- معالجة وتصحيح القصور في نواحي الصحة والسلامة والبيئة وسد الثغرات التي يتم تحديدها من خلال أعمال التدقيق والتفتيش والتحقيق في الحوادث وذلك بأسرع وقت ممكن.
- مواصلة تحسين أداء الشركة في مجالات الصحة والسلامة والبيئة عن طريق تعزيز الثقافة الايجابية التي تحفز المساهمات الفردية في هذه المجالات.
- قياس وتقييم وتعميم التقارير المتعلقة بكفاءة الاستدامة.

عبد المنعم سيف الكندي
الرئيس التنفيذي
Abdul Munim Saif Al Kindy
Chief Executive Officer

ADCO, January 25, 2011

أدكو، 25 يناير 2011

(1)
2009 Shah Incident

2009 Shah H2S Incident

2009 SHAH INCIDENT

FATALITIES DUE TO H2S RELEASE

2009 Shah H2S Incident (cont…)

- WHAT?
- WHERE?
- WHEN?
- WHO?
- WHY?

2009 Shah H2S Incident (cont…)

- **WHAT?**
  - Exposure to Toxic Gases (H2S and Hydrocarbons)
- **WHERE?**
  - Corrosion Coupon Pit (Near Shah-1 Station) on Shah-Asab Oil Transfer Line
- **WHEN?**
  - February 3rd,2009 Approximately at 0735 Hrs.
- **WHO?**
  - Four employees in Shah Field
- **WHY?**
  - Fatal exposure to H2S, H2S detector off, BA not used

(2)
What is H2S?

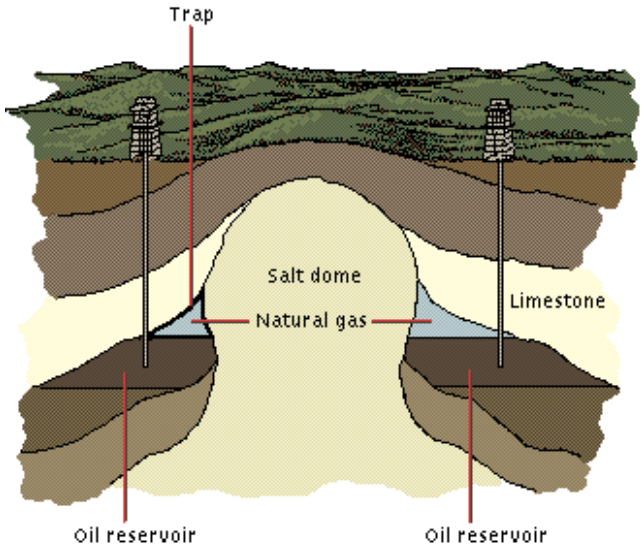
Introduction

- **H2S is a combination of hydrogen & sulphur atoms**
- **The process of combination by bio-chemical reaction, the decay, rotting down or breakdown of dead organic material**
- **Present where sour crude/gas exists**
- **Who is exposed to H2S :**
  - **Employees**
  - **Contractors**
  - **Anyone in close proximity of affected facility**

Formation of H2S

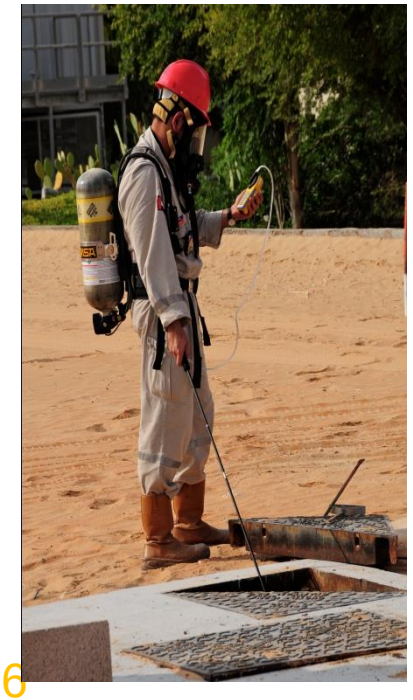
- **NATURAL** - Natural decomposition of organic material:
  - The original reservoir as a result of the hydrocarbon source material
  - The reservoir after prolonged injection of water with oxygen (souring)

- **ARTIFICIAL** - Chemical acid/caustic reactions
  - When acid is used to clean equipment containing iron sulphide



Sources of H2S

- Hydro Carbon &Petrochemical Process plants
- Pipelines holding Hydro Carbon &Petrochemicals
- Sewers and Swamps
- Stagnant water
- Water treatment plants
- Underground mining

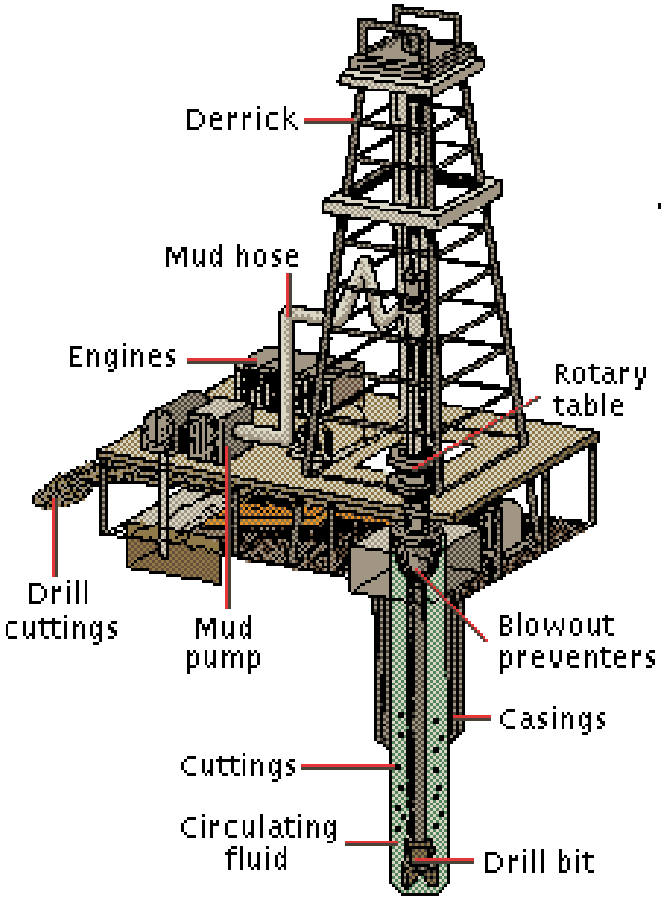


Sources of H2S in OGP

- Oil Production & Processing Facilities
- Degassing Stations
- Storage Facilities
- Refineries
- Sewage Treatment Plants
- During drilling and work over operation

Accumulation of H2S

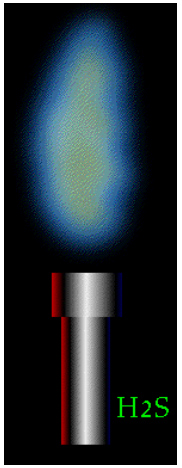
- BOP
- Shaker
- Trip tank
- Mud pit
- Joints
- Separators
- Choke Manif
- Cellar



Characteristics of H2S (cont…)

1. Colorless
2. Highly Toxic/Poisonous
3. Corrosive to metals and skin
4. No smell at higher concentrations
5. Rotten Egg smell at low concentrations
6. Soluble in both water and hydrocarbon liquids
7. Explosive range by volume in the air: 4.3% - 46%

Characteristics of H2S (cont…)



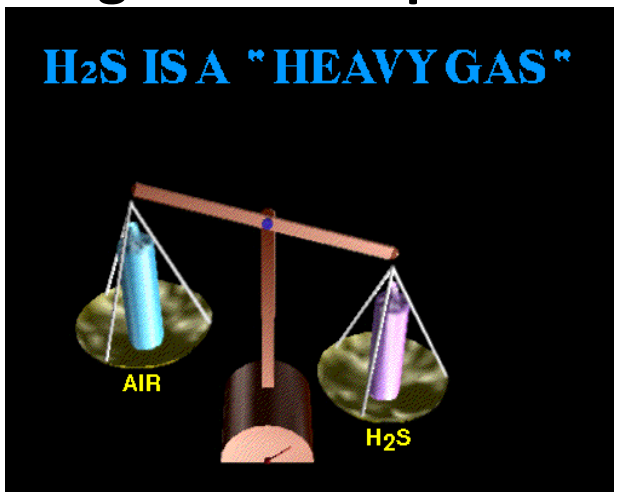
8. Normally present as a gas .

9. Dispersed by wind movement or air currents

10. H2S is heavier than air (specific gravity = 1.1895)

11. Burns with a blue flame and gives off sulphur dioxide (SO2)

12. Flammable gas, auto-ignition temperature of 260° C (500° F)

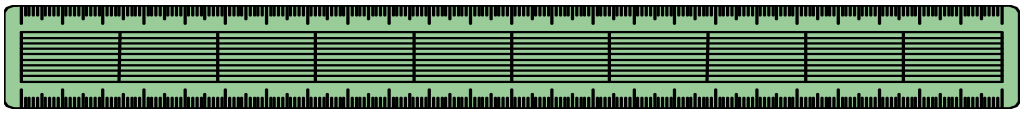


Common H2S names

- Sour Gas
- Rotten-Egg Gas
- Hydrogen Sulphide
- Stink Damp
- Sulphurated Hydrogen
- Hydrosulphuric Acid
- Sulphur Hydride
- Devil's Breath

Measurement of H2S

- H2S is measured in Parts Per Million (PPM)
- 1 PPM = 1 mm in 1 kilometre
- 1 cent in 10,000 USD



- H2S may be expressed in
  - PPM
  - % in the air

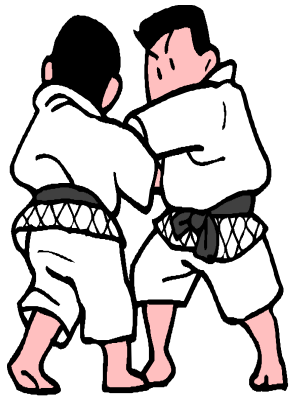
Concentration	% in air
1	0.0001%
10	0.001%
1000	0.1%
5000	0.5%
10,000	1%

(3)
Effects Of H2S

Health Effects of H2S

- **Breathing cycle**
  - ✓ **H2S goes to the lungs and into the Bloodstream & gets dissolved**

- **Defence System**
  - ✓ **The body's defence system operates. It breaks down H2S as rapidly as possible into a harmless compound.**
  - ✓ **With higher doses of H2S, the body's defence system will weaken. H2S settles in the blood and the individual becomes poisoned.**



Health Effects of H2S (cont…)

- Causes rapid damage to health or sudden death
- Causes stoppage of breathing at higher concentration
- If the victim survives, a complete recovery is possible in most cases.

Health Effects of H2S (cont…)

- **The effect of H2S on the human body depends on the following:**

  1. Duration

  2. Intensity

  3. Frequency

  4. Individual Susceptibility

Physiological Effects of H2S

- **At < 1 ppm:**
  - **Odor of rotten eggs can be clearly detected**

- **At 10 ppm:**
  - **Unpleasant odor. Possible eye irritation**

- **At 50 ppm:**
  - **15 min or more: Loss of sense of smell**
  - **60 min or more: headache, dizziness, and/or state of shock**

- **At > 50 ppm:**
  - **causes serious eye irritation or damage.**

Physiological Effects of H2S (cont…)

- **At 100 ppm:**
  - **After 3 to 15 min: Coughing, eye irritation, loss of sense of smell.**
  - **After 15 to 20 min: Altered respiration, pain in eyes, and drowsiness.**
  - **After 60 min: Throat irritation**

- **At 200 ppm:**
  - **The sense of smell will be lost rapidly,**
  - **and it will irritate the eyes and throat.**
  - **After 20 to 30 min: may cause accumulation of fluid in the lungs.**

Physiological Effects of H2S (cont…)

- **At 500 ppm:**
  - Unconsciousness after short exposure, breathing will stop if not treated quickly.
  - Dizziness, loss of sense of reasoning and balance.
  - Artificial ventilation and /or Cardio Pulmonary Resuscitation (CPR) techniques.

- **At > 1000 ppm:**
  - Unconsciousness at once.
  - Permanent brain damage or death.
  - Rescue promptly and apply (CPR).

Physiological Effects of H2S (cont…)

- **Three Categories for limits:**
  - **TLV/PEL**
    - Threshold Limit Value
    - Permissible Exposure Limit

    The Concentration that a worker can be exposed day after day for a working lifetime without adverse health effects

  - **TLV - TWA 10 PPM**
    - Time Weighted Average

    The permissible exposure limit concentration for a normal 8 hours work day

  - **TLV - STEL 15 PPM**
    - Short Term Exposure Limit
    - 15 min per exposure

    There should be no more than four such exposures per day, with at least 1 hour between exposures

  - **TLV – C / IDLH 100 PPM**
    - Ceiling
    - Immediately Dangerous to Life and Health

    This is the concentration level beyond which workers must never be exposed- even for an instant !

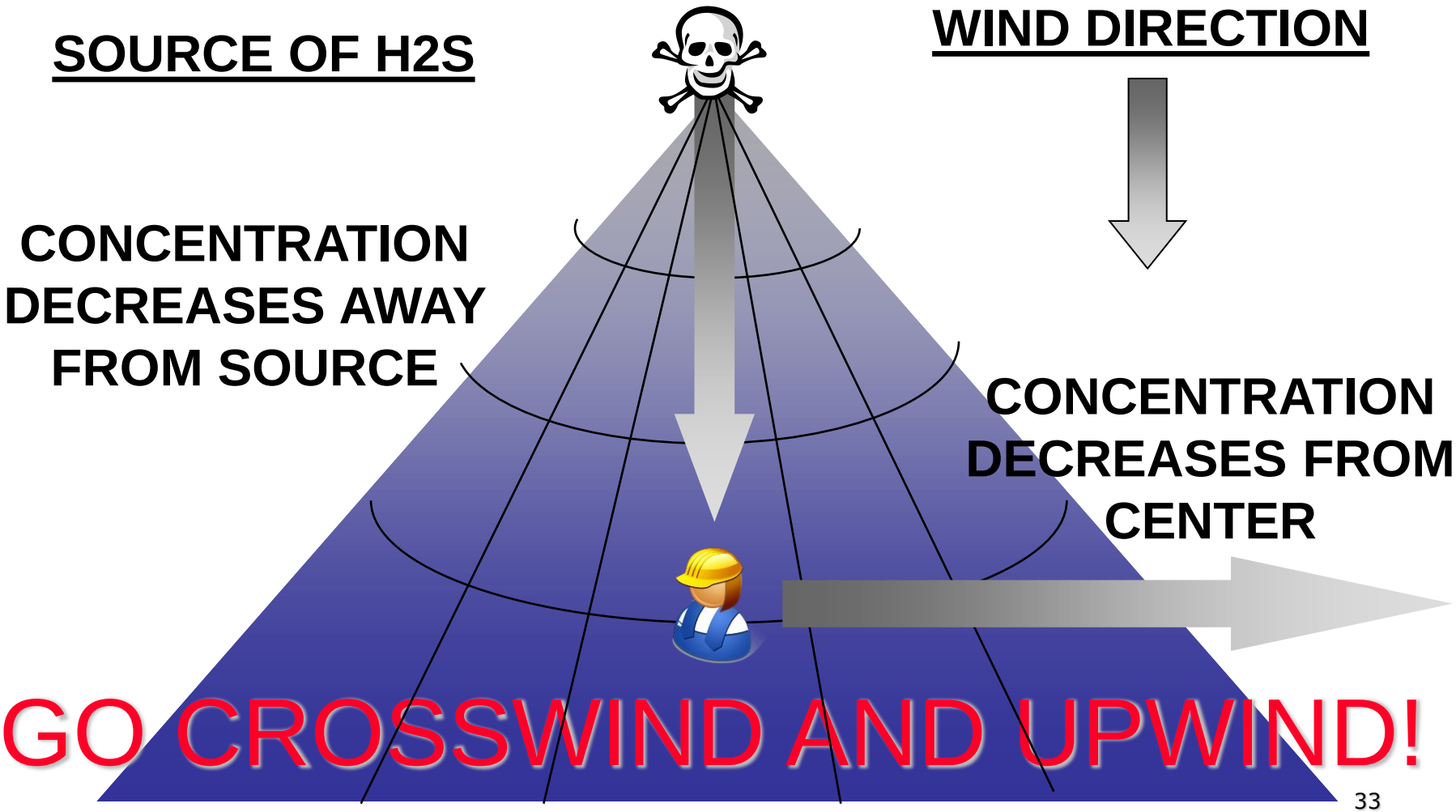
Environmental Effects of H2S

- **Emission should be set to protect people from toxic risks and avoid public nuisance.**
- **UAE air quality in respect of allowable concentration of H2S should be considered.**
- **Allowable emission concentrations can be as low as one (1)ppm H2S with a corresponding air quality of 0.02 ppm H2S over 30 minutes period.**
- **These levels do not present at toxic risk although they can result in a strong odor.**

Wind

- H2S is readily dispersed by the wind or air currents
- Observe the wind socks
- Always move upwind or crosswind to escape from H2S

Which way to go?



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Safety Effects of H2S

- **Effects on metals**
  - **H2S in the presence of free (untreated) water will be corrosive especially during abnormal situations, such as start-up and shut-down.**
  - **If carbon dioxide, oxygen, chloride ions, elemental sulphur are present either individually or together then severe corrosion may take place within a very short period.**

Safety Effects of H2S (cont…)

- **Effects on Pyrophoric Iron Sulphide**
  - Formation of Pyrophoric Iron scale (Iron Sulphide) in lines, vessels or equipment carrying gas or liquids
  - Pyrophoric iron scale can spontaneously ignite when exposed to air.
  - When joints have to be broken on pipelines, flowlines, vessels and equipment, the exposed metal should be doused with water to render harmless any potential pyrophoric iron scale that may be present.
  - Scale removed from such lines/equipment should be placed in a drum and immediately covered with water.

(4)
Protection Against H2S

Detection of H2S

1. Fixed Systems

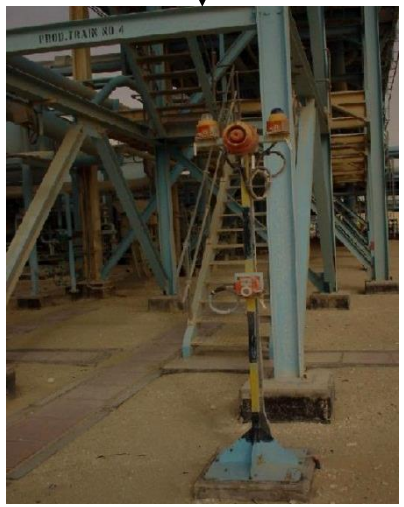
– **H2S detection systems be installed in High H2S Risk Areas.**

SEND A SIGNAL
TO MAIN PANEL

MAIN PANEL

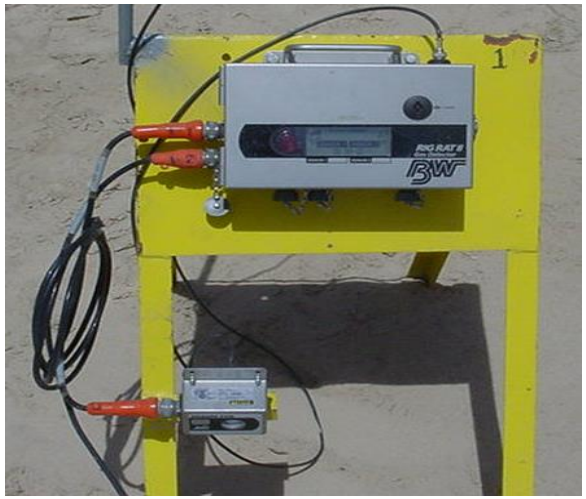
SEND A SIGNAL
TO ACTIVATE THE ALARM BLOCK

FIXED SENSORS
DETECTS 10 PPM OF H2S



ALARM BLOCK

Detection of H2S



2. Wireless Detectors
   - Uses radio signals
   - Solar charged battery
   - Placed in remote hazardous areas
   - Detects H2S and SO2
   - Alarm bar at air loop caravan and other areas as applicable
   - Alarms are activated at 10 ppm or above
   - Sensors are colored coded for recognition

Detection of H2S

3. Portable Detection System

- Install where it's not practical to install fixed sensors
- Back-up in the event of a fixed system failure
- Audible and visual warning (usually at 10 ppm)
- Continuous readout of H2S concentrations
- Only Authorized Gas Testers (AGT7) shall perform the monitoring surveys.

Detection of H2S (cont…)

4. Personal Monitors
   - "Personal" H2S monitors are only used as warning devices
   - Should always "On" when inside H2S suspected area

- Testing and Calibration
  - As per manufacturer recommendation
  - H2S detection systems are primarily warning devices:
    - Accuracy should be verified
    - Speed of response of the sensor

Warning of H2S

- **Warning/ Danger Signs**
  - **Vessels and pipelines individually identified**
  - **Points of access to H2S designated areas**
  - **In all common languages (English/ Arabic/ Urdu)**
  - **Windsocks where appropriate shall be sited**
  - **Emergency procedures shall be prominently displayed**

Warning of H2S (cont…)

- **Warning Signs**
  - **At the entrance of production and oil/gas processing facilities**
  - **All personnel beyond these signs shall be:**
    - **Well prepared with personal monitors and emergency escape BA sets**
    - **ADCO Facial Hair Policy shall be implemented by all B.A users.**

Warning of H2S (cont…)

- **Danger Signs**
  - **Fixed near the source of H2S (above 100 ppm)**
    - **Example: open pits containing sour crude/ gas valves, drains, gauges, joints, flanges or sour oil/gas wells cellars, open sumps, at the staircase of the sour tanks, etc.**
  - **Portable to indicate temporarily dangerous situations**
    - **Example: during handling of sludge or tank/ vessel opening or cleaning**

(5)
Breathing Apparatus (BA)

Breathing Apparatus (BA)

- **Respiratory Protective Equipment (RPE)**
  - **Provides a fresh supply of breathable air while in:**
    - **Contaminated atmospheres**
    - **Oxygen deficient atmospheres**
  - **Applications:**
    - **Confined spaces**
    - **H2S areas (concentration is at or suspected > 10ppm)**
    - **Fire fighting operations**

Escape Set

- **Emergency Escape Breathing Device (EEBD) with full face mask**
  - **Small compressed air cylinder**
  - **'Positive Pressure' mode**
  - **Duration: 10 or 15 min**
  - **Wearers shall be clean shaven**

Escape Set (cont…)

- **Emergency Escape Breathing Device (EEBD) with hood**
  - Small compressed air cylinder
  - Clear plastic hood sealed at neck
  - Easy to put on
  - Duration: 10 or 15 min

(6)
ADCO Facial Hair Policy

ADCO Facial Hair Policy

International standards and respiratory protection manufacturers have shown that when wearing beard, at peak inhalation rates it is not possible to guarantee a positive pressure inside the mask at all times and some inward leakage will occur.

ADCO Facial Hair Policy (cont…)

- A good seal around the face will only be obtained if the skin in the region of the seal is smooth and without hair.

- It shall be the policy of ADCO that employees; be ADCO or Contractors; who will use tight-fitting face piece in any irrespirable atmosphere shall be clean shaven as demonstrated in the following sketches.

ADCO Facial Hair Policy (cont…)

Accepted

Clean Shaven

Narrow Mustache

ADCO Facial Hair Policy (cont…)

Not Accepted

Full Beard

Long Mustache

Wide Mustache

Small Beard

Side Burns

ADCO Facial Hair Policy (cont…)

- **Examples of employees who must be clean shaven:**
  - Entrants to a contaminated confined spaces or deep excavations as per ADCO Permit to Work procedures
  - Confined space stand-by persons or rescuers
  - Fire fighting or auxiliary fire team
  - Hazmat and emergency response team members
  - Rig site crew and wellhead activities such as wire-line operations, rigless operations
  - Oil/Gas plant operations and maintenance crews.

ADCO Facial Hair Policy (cont…)

- **Visitors:**

Outsiders who are located at the site for a short time and are not required or expected to interact with any part of the plant where they might be exposed to H2S.

In restricted areas:

- **Accompanied by authorized responsible site employee**
- **Provided with emergency escape breathing apparatus**

All visitors must be familiar with the use of ADCO approved escape breathing apparatus and must demonstrate their ability to don them correctly and safety.

Additional Precautious

- **Contact Lenses:** Contact lenses are a definite hazard and should not be worn while wearing a respirator.

- **Corrective glasses:** Corrective spectacles with temple bars or straps that interfere with the respirator face seal.

(7)
H2S in ADCO

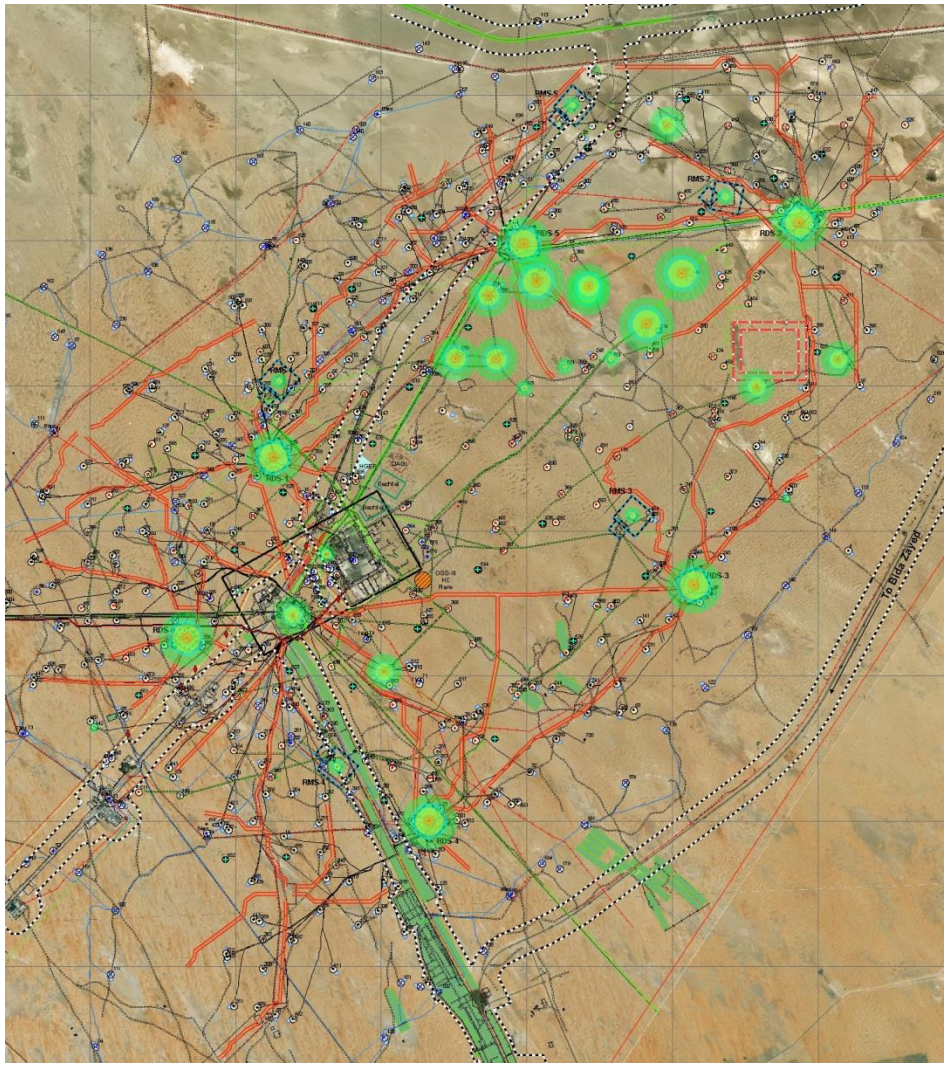
H2S in ADCO Fields

Field	H2S Concentration
BAB	370,000 ppm
BU HASA	9,000 ppm
ASAB	100 ppm (Gas well drilled in ‘08 shows 11%)
SAHIL	500 ppm
SHAH	3,000 ppm (Gas well drilled in ‘09 shows 25%)
NEB	15,000 ppm
JDA	70 ppm

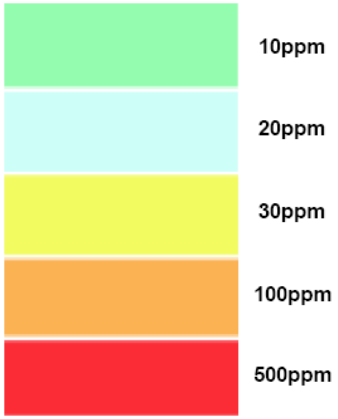
H2S Classification Areas

Area Classification	Company and H2S Zone Classification Criteria (PPM)			
	ERPG	API	SHELL	PDO
Low Risk	0.1	>10	<50	0-49
Medium Risk	30	>10 but <30	50-500	50-499
High Risk	100	>30	>500	>500
Very high Risk	N/A	N/A	N/A	BA worn at all times

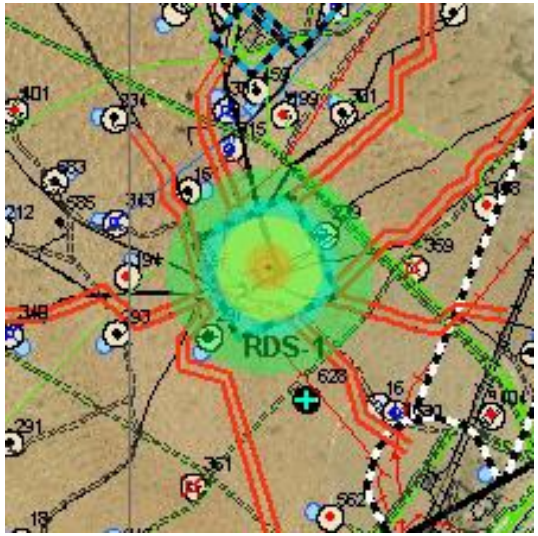
H2S Dispersion Contours (Examples)



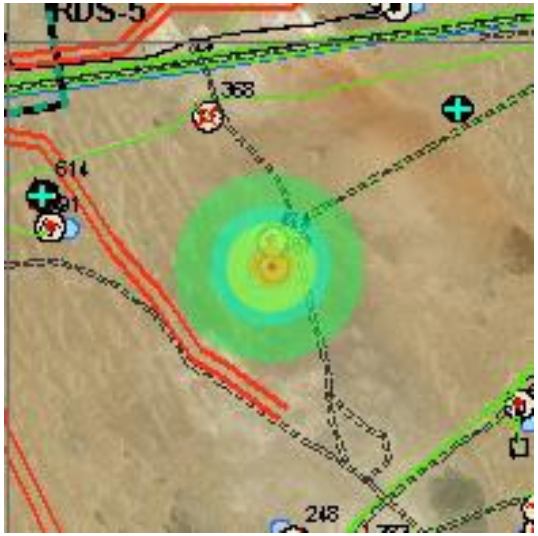
Bab Field Overview



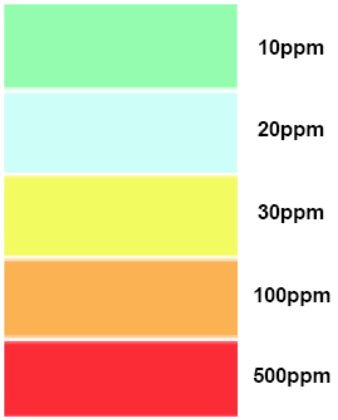
H2S Dispersion Contours (Examples)



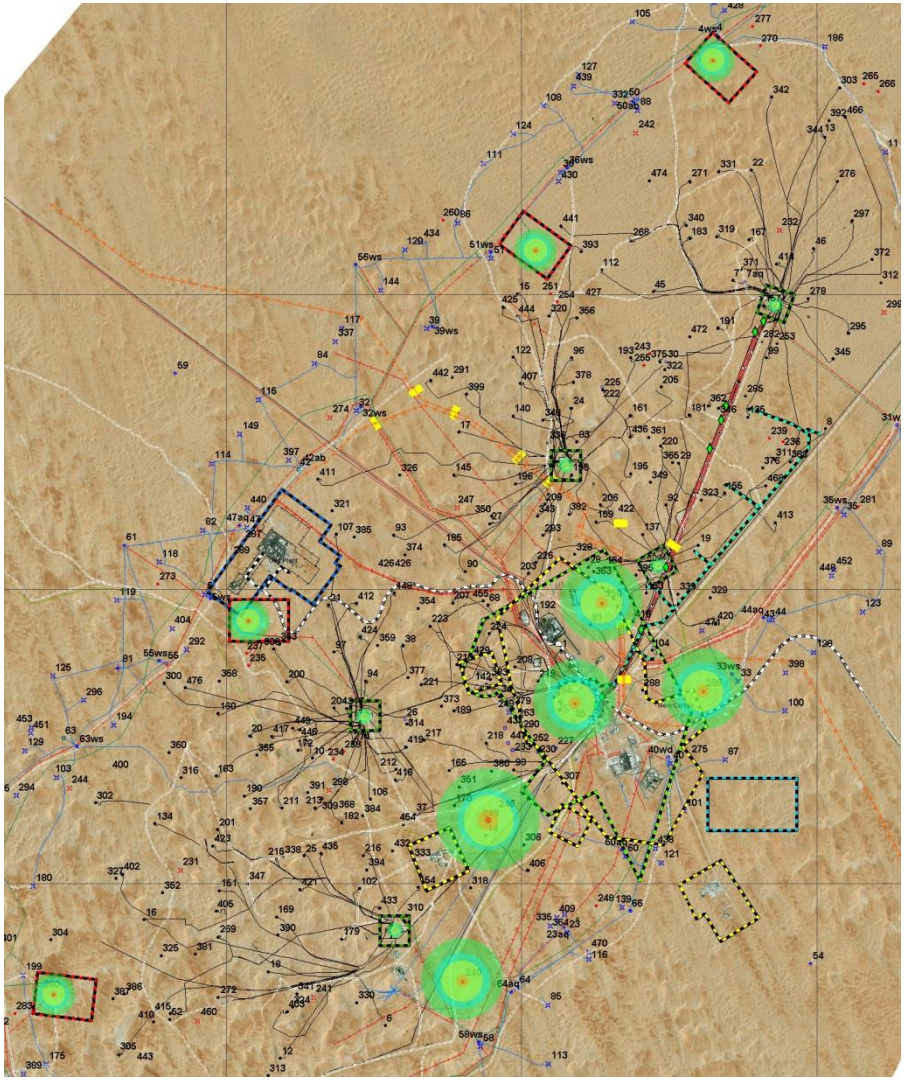
RDS 1 Bab



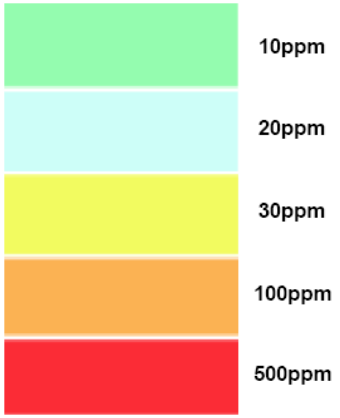
Gas Well example Bab



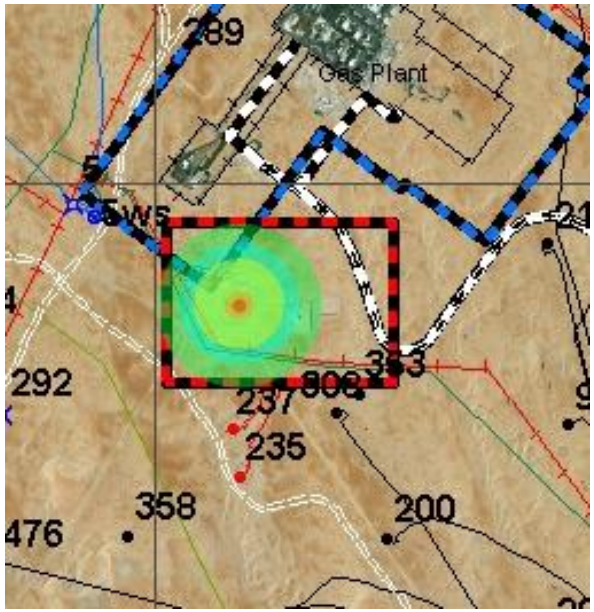
H2S Dispersion Contours (Examples)



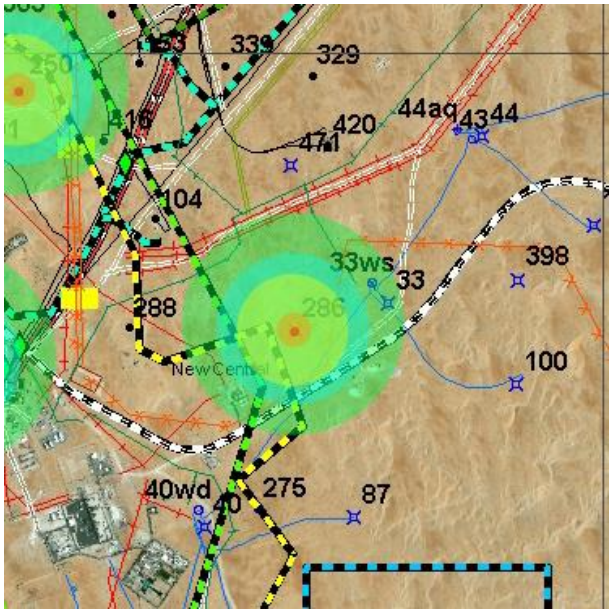
Asab Field Overview



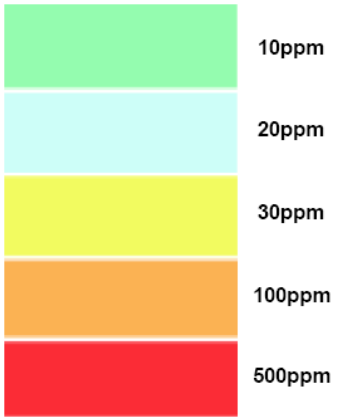
H2S Dispersion Contours (Examples)



GRS 2 Asab



Gas Injection Asab



H2S – Bab Field Dispersion Distances

Physical Effect Modeling – 1.5% H_2S Dispersion Distances in meters							
1.5% H_2S	1 ppm	10 ppm	100 ppm	500 ppm	650 ppm	1000 ppm	1320 ppm
	TLV® *ACGIH*	PEL *OSHA*	IDLH *NIOSH*	-	LC1 *HSE, UK*	LC50 *HSE, UK*	LC100 *HSE, UK*
Well Head	900	575	275	106	NA	NA	NA
Flow Line	5000	2500	450	60	42	25	18
Transfer Line	10000	4250	940	130	95	55	40

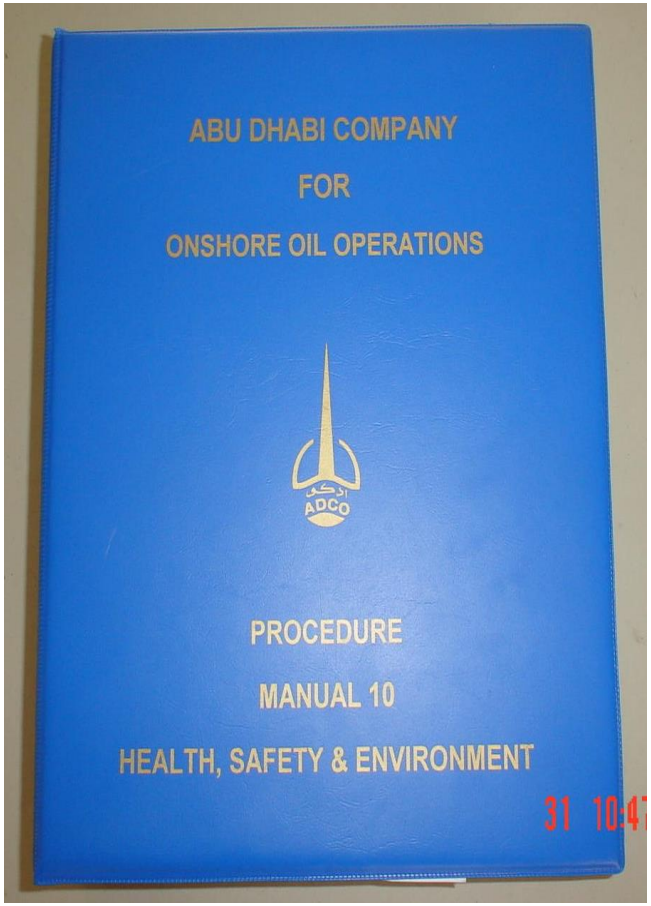
Note: Most people can smell H2S at very low concentration of 0.025 ppm and H2S smell in an area do not necessarily mean immediate danger.

H2S – Bab Field Dispersion Distances

Physical Effect Modeling – 16.5% H_2S Dispersion Distances in meters							
16.5% H_2S	1 ppm	10 ppm	100 ppm	500 ppm	650 ppm	1000 ppm	1320 ppm
	TLV® *ACGIH*	PEL *OSHA*	IDLH *NIOSH*	-	LC1 *HSE, UK*	LC50 *HSE, UK*	LC100 *HSE, UK*
Well Head	3000	1300	690	450	425	385	360
Flow Line	8100	3350	1500	810	740	640	575
Transfer Line (10% H2S)	50000	7300	2600	595	475	300	215

Protection against H2S

- **<u>Volume 10 part 8:</u> Protection against H2S Recommended Practices & Contingency Plans**



Access Control

- **Fixed Surface Facilities (within 400m)**

- **Fenced work site: two means of entry/exist considering the prevailing wind direction as per API RP-49**

Access Control (cont…)

- Sign in/out at central control room (certification verification)

- Hold Tool Box Talk (TBT)
- Apply head counts system
- Use calibrated H2S detection equipment
- Define Assembly point (upwind/ cross-wind direction)

Access Control (cont…)

- Use escape or BA sets
- Work singly or in pairs (buddy system)
- Use intrinsically safe/ explosion proof communication
- Close supervision for non-H2S trained personnel as required
- Task Risk Assessment (TRA) should be prepared
- Unauthorized entry into pits or trenches as confirmed shall be prohibited

H2S Protection Level in ADCO

1. **Type of Situation – Visits:**
   - Outside visitor, management audits, inspection of worksite (with beard)

- **50ppm<H2S<200ppm:**
  - If less than 50ppm, monitor
  - From 50ppm to 200ppm: monitor + air hood escape set close to hand

- **H2S>200ppm:**
  - Monitor + Escape BA (+ve pressure) close to hand
  - Air hood for bearded visitors

H2S Protection Level in ADCO (cont…)

2. **Type of Situation – Inspections:**
   - Maintenance supervisors, engineers inspecting worksite (clean shaven)

- **50ppm<H2S<200ppm:**
  - If less than 50ppm, monitor
  - From 50ppm to 200ppm: monitor + Escape BA with full face mask close to hand

- **H2S>200ppm:**
  - Monitor + Escape BA (+ve pressure) close to hand

H2S Protection Level in ADCO (cont…)

3. **Type of Situation – Normal Operations:**
   - Operator checking instrument reading, stopping/starting pumps, excluding any live work (i.e. tank sampling)

- **50ppm<H2S<200ppm:**
  - Monitor + Escape BA with full face mask close to hand

- **H2S>200ppm:**
  - Monitor + Escape BA (+ve pressure) close to hand

H2S Protection Level in ADCO (cont…)

4. **Type of Situation – Works near 'H2S-live' equipment:**
   - Any work near flanged piping, pumps, vessels, compressors, etc in which H2S-containing fluids can escape through flanges, seals, vents or breather valves into the immediate atmosphere

- **50ppm<H2S<200ppm:**
  - Monitor + Escape BA with full face mask close to hand

- **H2S>200ppm:**
  - Monitor + Escape BA (+ve pressure) set with mask close to hand

H2S Protection Level in ADCO (cont…)

5. Type of Situation – Works disturbing 'H2S-live' equipment:
   - Testing newly commissioned rotating equipment. Modifying piping where stresses could be transmitted to live piping. Adjusting and calibrating 'wet' components of instruments.

- 50ppm<H2S<200ppm:
  - Monitor + Escape BA with full face mask close to hand

- H2S>200ppm:
  - Monitor + Escape BA (+ve pressure) set with mast close to hand
  - At least one standby with BA set

H2S Protection Level in ADCO (cont…)

6. **Type of Situation – Sampling and dipping:**
   - Taking gas or liquid samples.
   - Dipping a tank

- **All H2S Concentrations:**
  - Monitor
  - BA Set – Mask Fitted
  - At least one standby with BA Set

H2S Protection Level in ADCO (cont…)

7. **Type of Situation – Opening Live Equipment:**
   - Turning a spade
   - Removing blank to allow gas test
   - Making a gas test

- **All H2S Concentrations:**
  - Monitor
  - BA Set – Mask Fitted
  - At least two standby with BA Set (one if fully depressurized)

H2S Protection Level in ADCO (cont…)

8. Type of Situation – Leaking Equipment:
   - Investigating a leak
   - Isolating leaking equipment

- All H2S Concentrations:
  - Monitor
  - BA Set – Mask Fitted
  - At least two standby with BA Set

H2S Protection Level in ADCO (cont…)

9. Type of Situation – Entry into low lying area:
   - Working on tank bund or pipe trenches
   - Accessing tanks via bundled area

- All H2S Concentrations:
  - Monitor
  - Escape set if gas test shows H2S free
  - Mask fitted if not gas tested
  - At least one standby with BA Set

H2S Protection Level in ADCO (cont…)

10. **Type of Situation – Entry into vessel or other confined space:**
    - Entry into vessels, tanks, buildings or compartments containing process equipment with H2S

- **All H2S Concentrations:**
  - Monitor
  - Escape only once isolated, gas freed and air flow established
  - BA Set mask fitted
  - At least two standby with BA Set (one if isolated and gas freed)

H2S Protection Level in ADCO (cont…)

11. **Type of Situation – Entry into suspected unmonitored area:**
    - Arrival at unmanned platform or production facility where integrity of H2S detection systems is in doubt.

- **All H2S Concentrations:**
  - Monitor
  - BA Set mask fitted
  - At least two standby with BA Set

H2S Procedural Controls

1. **Drilling and Well Operations**
   - Conduct H2S risk assessment and include in drilling program
   - Develop Integrated Contingency Plan by field SVP
   - Maintain RPE on well site
   - Provide method for igniting the gas (uncontrollable event)
   - Install H2S well control equipment
   - Conduct drill stem test for H2S zones during daylight hours

H2S Procedural Controls (cont…)

2. Vessel Entry (full procedure CPR-HSE-10-03 Permit to Work)

- **First open of vessel:**
  - Full SCBA by persons
  - One person watching from a distance
- **Check for debris and H2S on removal**
- **If debris is present:**
  - damping it down to keep from air
- **SCBA should be worn:**
  - Until H2S level is below 10ppm
  - All debris is removed

H2S Procedural Controls (cont…)

2. Vessel Entry (cont…)

- **Confined space entry into vessel:**
  - Safety line
  - Full SCBA
  - H2S detector

- **In case of detector alarm:**
  - Identify cause
  - Take action to reduce to below 10ppm

H2S Procedural Controls (cont…)

3. Maintenance Operations

- Planning and execution should be done under the supervision of a competent supervisor (area authority).
- AA is to coordinate with maintenance stakeholders
- Method of Statement and TRA should be incorporated
- Planning includes:
  - Action party and responsibilities
  - Operational constrains
  - Hazards carried in the line or equipment
  - Any work in the vicinity

H2S Procedural Controls (cont…)

3. Maintenance Operations (cont…)

- **Prior to execution, inspection shall be carried out:**
  - Survey the surrounding area
  - Check any work in the vicinity
  - Verify location of fire equipment and RPE
  - Assess any additional equipment required

Recovery

1. **Contingency Plan for major H2S release**
   - **A written action plan is required (ppm>10) including:**
     - **Site of H2S risk areas**
     - **Setting of H2S emergency equipment**
     - **Interpretation of area H2S alarm**
     - **Rescue operation**
     - **First Aid treatment for H2S poisoning**
     - **Action on hearing area H2S gas alarm, i.e.:**
       - **Road Closures**
       - **Assembly points and escape routes**
       - **Search and Rescue**
       - **Wearing BA and using H2S Detection systems**
       - **Stopping Hot or cold work**
       - **Locating and dispersing a leak source**
       - **Procedures of all clear and return to work**

Recovery (cont…)

2. Rescue Procedures

- A rescue plan - developed and practiced for effectiveness
- Local medical facility should be fully aware of treatment of H2S poisoning
- Rescue procedure should have single action of the witness to set the procedure in action. i.e. raise the specific alarm
- Rescue procedure should contain:
  - Central reporting point (control room)
  - Reporting Code (H2S Victim)
  - Witness action
  - Reporting point actions

Recovery (cont…)

3. First Aid and Medical Advice

- **H2S poisoning – loss of consciousness & respiratory failure:**
  - Remove H2S victim to an H2S free area
  - Apply artificial respiration until mechanical resuscitator is available
  - Obtain medical attention immediately
  - Flush eyes with clean water is eye contamination is suspected
  - Keep victim under observation

Recovery (cont…)

4. Firefighting

- H2S is a flammable gas and burn on ignition (4.3 – 46.0)
- In the event of a fire of H2S-containing material:
  - Let the fire burn under control until source isolated
  - Cool surrounding equipment
  - Attempt to disperse SO2 by water sprays
  - Extinguish fire if it is small in volume and can be isolated easily

All approaches must be from an upwind direction by personnel wearing SCBA

(8)
Summary

Summary

- H2S can kill you.
- H2S Stinks of rotten eggs @ low concentrations
- H2s is heavier than air.
- Make sure sensors are working properly.
- Be familiar with site emergency response plan
- Know where to find & how to use your SCBA.
- When in DOUBT, ASK

Know and remember these facts, they will save your life !!!

(9)
Assessment