

Hydrogen Sulfide drilling Operations Plan
McQuadrangle, Inc.
Midnight Matador Fed. "A" No. 1
Eddy County, New Mexico

30-015-33351

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I. Hydrogen Sulfide Training: All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, will receive training from a qualified instructor in the following areas prior to commencing drilling operations on this well:

1. The hazards and characteristics of hydrogen sulfide (H₂S).
2. The proper use and maintenance of personal protective equipment and life support systems.
3. The proper use of H₂S detectors, alarms, warning systems, briefing areas, evacuation procedures, and prevailing winds.
4. The proper techniques for first aid and rescue procedures.

In addition, supervisory personnel will be trained in the following areas:

1. The effects of H₂S on metal components. If high tensile tubulars are to be used, personnel will be trained in their special maintenance requirements.
2. Corrective action and shut-in procedures when drilling or reworking a well and blowout prevention and well control procedures.
3. The contents and requirements of the H₂S Drilling Operations Plan and the Public Protection Plan.

There will be an initial training session just prior to encountering a known or probable H₂S zone (within 3 days or 500') and weekly H₂S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H₂S Drilling Operations Plan and the Public Protection Plan. This Plan shall be available at the well site. All personnel will be required to carry documentation that they have received the proper training.

II. H₂S Safety Equipment and Systems; All H₂S safety equipment and systems will be installed, tested, and operational when drilling reaches a depth of 500' above, or 3 days prior to penetrating the first zone containing or reasonably expected to contain H₂S.

1. Well Control Equipment:
 - A. Flare line with electronic igniter or continuous pilot.
 - B. Choke manifold with a minimum of 1 remote choke.

C. Blind rams and pipe rams to accommodate all pipe sizes with properly sized closing unit.

D. Auxiliary equipment will include annular preventer, mud-gas separator, rotating head, and flare gun with flares.

2. Protective equipment for essential personnel is Mark II Surviveair 30 minute units located in the dog house and at briefing areas, as indicated on well site diagram.

3. H2S Detection and Monitoring Equipment:

A. 2 portable H2S monitors positioned on location for best coverage and response. These units have warning lights and audible sirens when H2S levels of 20 ppm are reached.

B. 1 portable SO2 monitor positioned near flare line.

4. Visual Warning Systems:

A. Wind direction indicators as shown on well site diagram.

B. Caution/Danger signs shall be posted on roads providing direct access to the location. Signs will be painted a high visibility yellow with black lettering of sufficient size to be readable at a reasonable distance from the immediate location. When appropriate, bilingual signs will be used.

5. Mud Program:

A. The mud program has been designed to minimize the volume of H2S circulated to the surface. Proper mud weight, safe drilling practices, and the use of H2S scavengers will minimize hazards when penetrating H2S bearing zones.

B. A mud-gas separator and an H2S gas buster will be utilized.

6. Metallurgy:

A. All drill strings, casings, tubing, wellhead, B. O. P., drilling spool, kill lines, choke manifold and lines, and valves shall be suitable for H2S service.

B. All elastomers used for packing and seals shall be H2S trim.

7. Communication:

A. Radio communications in company vehicles included cellular telephone and 2-way radio.

B. Telephone communications at field office.

8. Well Testing: Drill stem testing will be performed with the minimum number of personnel in the immediate area necessary to safely and adequately conduct the testing. The drill stem testing will be conducted during daylight hours and formation fluids will not be flowed to the surface. All drill stem testing operations conducted in an H₂S environment will use the closed chamber method of testing.

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If at this time the supervising person determines the release of H2S cannot be contained to the site location and the general public is in harms way he will take the necessary steps to protect the workers and the public.

EMERGENCY CALL LIST: (Start and continue until ONE of these people have been contacted)

	OFFICE	MOBILE	HOME
Delbert G. McDougal	806 797-3162	806 797-5731	806 794-5223
Charles C. Joy	505 746-2480	505 748-5658	505 746-2480
Horace Delong	505 677-2334	505 748-7596	505 677-2334
Buddy Delong	505 746-4716	505 369-5392	505 746-4716

EMERGENCY RESPONSE NUMBERS:

State Police	Eddy County	505 748-9718
Sheriff	Eddy County	505 746-9888
Emergency Medical Ser. (Ambulance)	Eddy County	911 or 505-746-2701
Artesia Police Dept.		505 746-5001

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Artesia Fire Dept.		505 746-5001
Loco Hills Fire Dept.		505 677-2349
American Safety, Inc.		505 746-1096
BJ Services	Artesia	505 746-3140
Halliburton	Artesia	1 800 523-2482
Wild Well Control	Midland, TX	432 550-6202
	Mobile	432 553-1166
	Houston, TX	281 353-5481

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General H2S Emergency Actions:

1. All personnel will immediately evacuate to an up-wind and if possible up-hill "safe area"
2. If for any reason a person must enter the hazardous area, they must wear a SCBA (Self Contained Breathing Apparatus)
3. Always use the "buddy system"
4. Isolate the well/problem if possible
5. Account for all personnel
6. Display the proper colors warning all unsuspecting personnel of the danger at hand.
7. Contact the Company personnel as soon as possible if not at the location. (use the enclosed call list as instructed

At this point the company representative will evaluate the situation and coordinate the necessary duties to bring the situation under control, and if necessary, the notification of the emergency response agencies and nearby residents.

EMERGENCY PROCEDURES FOR AN UNCONTROLLABLE RELEASE OF H2S

1. All personnel will don the self contained breathing apparatus.
2. Remove all personnel to the "safe area". (always use the buddy system).
3. Contact company personnel if not on location.
4. Set in motion the steps to protect and or remove the general public to an upwind "safe area". Maintain strict security & safety procedures while dealing with the source.
5. No entry to any unauthorized personnel.
6. Notify the appropriate agencies: City Police-City Street (s)
State Police- State Rd
County Sheriff – County Rd.
7. Call the NMOCD

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PROTECTION OF THE GENERAL PUBLIC (ROE):

- 100 ppm at any public area (any place not associated with this site)
- 500 ppm at any public road (any road which the general public may travel)
- 100 ppm radius of ¼ mile in New Mexico will be assumed if there is insufficient data to do the calculations, and there is a reasonable expectation that H2S could be present in concentrations greater than 100 ppm in the gas mixture

CALCULATIONS FOR THE 100 PPM (ROE) "Pasquill-Gifford equation"

$X = [(1.589) (\text{mole fraction}) (Q\text{-volume in std cu ft})] \text{ to the power of } (0.6258)$

CALCULATION FOR THE 500 PPM ROE:

$X = [(.4546) (\text{mole fraction}) (Q\text{-volume in std cu ft})] \text{ to the power of } (0.6258)$

Example:

If a well/facility has been determined to have 150 / 500 ppm H2S in the gas mixture and the well/facility is producing at a gas rate of 100 MCFPD then:

150 ppm $X = [(1.589) (.00015) (100,000 \text{ cfd})] \text{ to the power of } (.6258)$
 $X = 7 \text{ ft}$

500 ppm $X = [(.4546) (.0005) (100,000 \text{ cfd})] \text{ to the power of } (.6258)$
 $X = 3.3 \text{ ft}$

(These calculations will be forwarded to the appropriate District NMOCD office when Applicable)

PUBLIC EVACUATION PLAN:

- 1. Notification of the emergency response agencies of the hazardous condition and implement evacuation procedures.
- A trained person in H2S safety, shall monitor with detection equipment the H2S concentration, wind and area exposure (ROE). This person will determine the outer perimeter of the hazardous area. The extent of the evacuation area will be determined from the data being collected. Monitoring shall continue until the situation has been resolved. (All monitoring equipment shall be UL approved, for use in class 1

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groups A,B,C &D, Division 1, hazardous locations. All monitor will have a minimum capability of measuring H₂S , oxygen, and flammable values).

- Law enforcement shall be notified to set up necessary barriers and maintain such for the duration of the situation as well as aid in the evacuation procedure.
- The company supervising personnel shall stay in communication with all agencies through out the duration of the situation and inform such agencies when the situation has been contained and the effected area(s) is safe to enter.

PROCEDURE FOR IGNITING AN UNCONTROLABLE CONDITION:

- 1. Human life and/or property are in danger
- 2. There is no hope of bringing the situation under control with the prevailing conditions at the site.

INSTRUCTION FOR IGNITION:

- 1. Two people are required. They must be equipped with positive pressure, self contained breathing apparatus and a "D" ring style full body, OSHA approved safety harness. Non flammable rope will be attached.
- 2. One of the people will be qualified safety person who will test the atmosphere for H₂S, Oxygen & LFL. The other person will be the company supervisor; he is responsible for igniting the well.
- 3. Ignite up wind from a distance no closer than necessary. Make sure that where you ignite from has the maximum escape avenue available. A 25 mm flare gun shall be used, with a ± 500 ft. range to ignite the gas.
- 4. Prior to ignition, make a final check for combustible gases.
- 5. Following ignition, continue with the emergency actions & procedures as before.

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REQUIRED EMERGENCY EQUIPMENT:

- **1. Breathing apparatus:**
 - Rescue Packs (SCBA) – 1 unit shall be placed at each breathing area, 2 shall be stored in the safety trailer.
 - Work/Escapes packs – 4 packs shall be stored on the rig floor with sufficient air hose not to restrict work activity.
 - Emergency Escape Packs – 4 packs shall be stored in the doghouse for emergency evacuation.
- **2. Signage & Flagging:**
 - One color code condition sign will be placed at the entrance to the site reflection the possible conditions at the site.
 - A colored condition flag will be on display, reflecting the condition at the site at the time.
- **3. Briefing Area:** two perpendicular areas will be designated by signs and readily accessible.
- **4. Wind Socks:** Two wind socks will be placed in strategic locations, visible from all angles.
- **5. H₂S detectors and alarms:** The stationary detector with three sensors will be placed in the upper dog house if equipped, set to visually alarm @ 10 ppm and audible @ 14 ppm. Calibrate a minimum of every 30 days or as needed. The sensors will be placed in the following places: (Gas sample tubes will be stored in the safety trailer)
 - Rig Floor
 - Bell Nipple
 - End of Flow line or where well bore fluid are being discharged.
- **6. Auxiliary Rescue Equipment:**
 - Stretcher
 - Two OSHA full body harness
 - 100 ft 5/8 inch OSHA approved rope

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- 1-20# class ABC fire extinguisher
- Communication via cell phones on location and vehicles on location.

USING SELF CONTAINED BREATHING AIR EQUIPMENT (SCBA):

- (SCBA) SHOULD BE WORN WHEN ANY OF THE FOLLOWING ARE PERFORMED:
 - Working near the top or on top of a tank
 - Disconnecting any line where H₂S can reasonably be expected
 - Sampling air in the area to determine if toxic concentrations of H₂S exist.
 - Working in areas where over 10 ppm on H₂S has been detected.
 - At any time there is a doubt as the level of H₂S in the area.
- All personnel shall be trained in the use of SCBA prior to working in a potentially hazardous location.
- Facial hair and standard eyeglasses are not allowed with SCBA.
- Contact lenses are never allowed with SCBA.
- Air quality shall be continuously be checked during the entire operation.
- After each use, the SCBA unit shall be cleaned, disinfected, serviced and inspected
- All SCBA shall be inspected monthly.

RESCUE AND FIRST AID FOR VICTIMS OF HYDROGEN SULFIDE (H₂S) POISONING:

- Do not panic
- Remain Calm & think
- Get on the breathing apparatus

HYDROGEN SULFIDE TOXIC EFFECTS

H₂S is extremely toxic. The acceptable ceiling for eight hours of exposure is 10 ppm, which is .001% by volume. H₂S is approximately 20% heavier than air (Sp. Gr= 1.19)(Air = 1) and colorless. It forms an explosive mixture with air between 4.3% and 46%. By volume hydrogen sulfide is almost as toxic as hydrogen cyanide and is 5-6 times more toxic than carbon monoxide.

Various Gases

COMMON NAME	CHEMICAL ABBREV.	SPECIFIC GRVTY.	THRESHOLD LIMITS	HAZARDOUS LIMITS	LETHAL CONCENTRATIONS
Hydrogen Sulfide	H ₂ S	1.19	10ppm 15 ppm	100 ppm/hr	600 ppm
Hydrogen Cyanide	HCN	0.94	10 ppm	150 ppm/hr	300 ppm
Sulfur Dioxide	SO ₂	2.21	2 ppm	N/A	1000 ppm
Chlorine	CL ₂	2.46	1 ppm	4 ppm/hr	1000 ppm
Carbon Monoxide	CO	0.97	60 ppm	400 ppm/hr	1000 ppm
Carbon Dioxide	CO ₂	1.52	5000 ppm	5%	10%
Methane	CH ₄	0.55	90,000	Combustible @ 5%	N/A

Threshold limit: Concentrations at which it is believed that all workers may be repeatedly exposed, day after day without adverse effects.

Hazardous Limit: Concentrations that may cause death

Lethal

Concentrations: Concentrations that will cause death with short term exposure

Threshold limit -

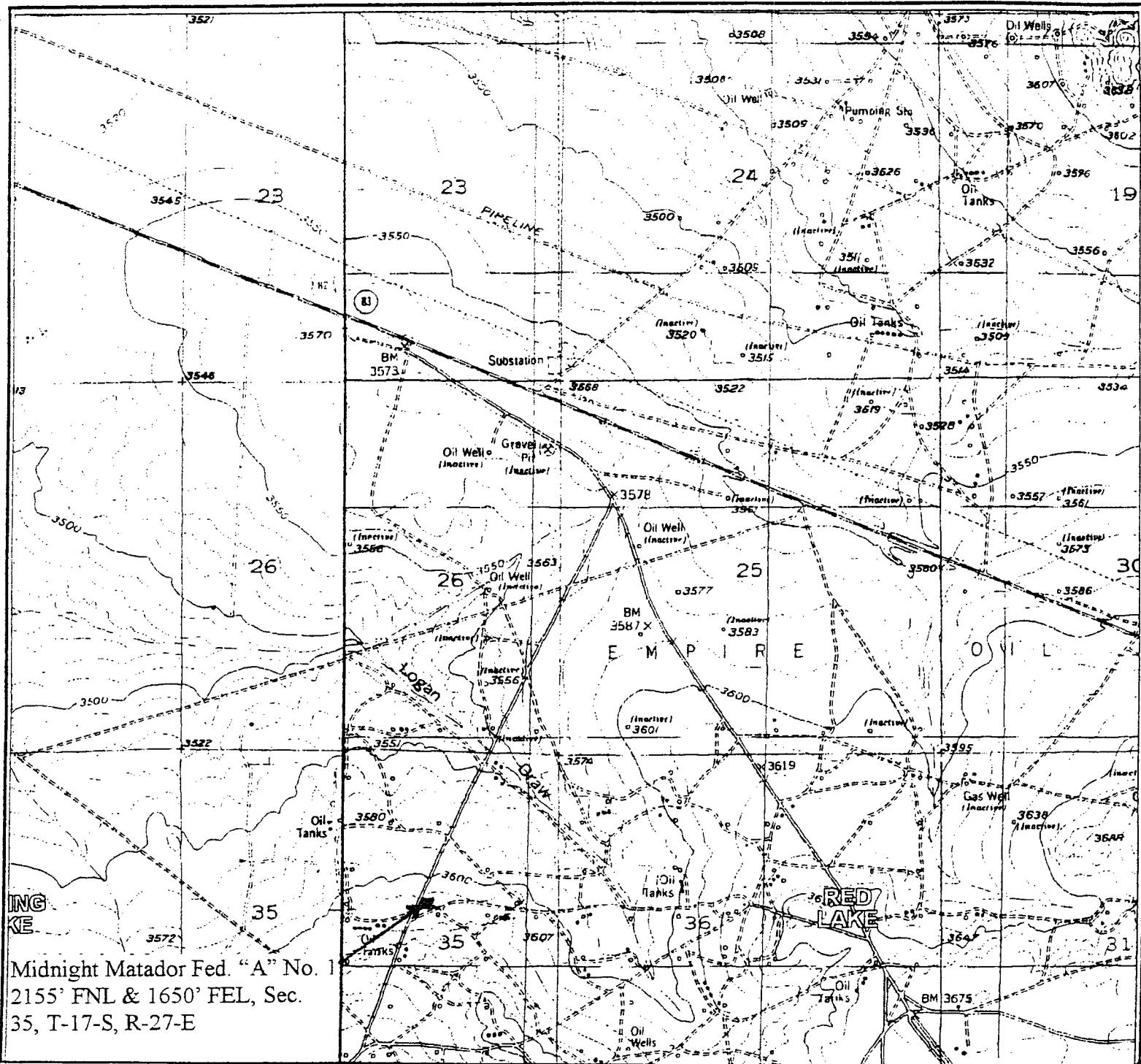
10 ppm: NIOSH guide to chemical hazards

PHYSICAL EFFECTS OF HYDROGEN SULFIDE:

CONCENTRATION	PHYSICAL EFFECTS
.001% 10 PPM	Obvious and unpleasant odor. Safe for 8 hr exposure
.005% 50 ppm	Can cause some flu like symptoms and can cause pneumonia
.01% 100 ppm	Kills the sense of smell in 3-15 minutes. May irritate the eyes and throat.
.02% 200 ppm	Kills the sense of smell rapidly. Severely irritates the eyes and throat. Severe flu like symptoms after 4 or more ours. May cause lung damage and or death.
.06% 600 ppm	Loss of consciousness quickly, death will result if not rescued promptly.

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- Remove the victim to the safe breathing area as quickly as possible. Up wind and uphill from source or cross wind to achieve upwind.
- Notify emergency response personnel.
- Provide artificial respiration and or CPR, as necessary
- Remove all contaminated clothing to avoid further exposure.
- A minimum of two personnel on location shall be trained in CPR and First Aid.



Midnight Matador Fed. "A" No. 1
 2155' FNL & 1650' FEL, Sec.
 35, T-17-S, R-27-E