

Arrow S Energy Operating, LLC H₂S Contingency Plan

Pad Description

Pad Names: ASE SOUTH - PAD A3

Latitude: 28° 43' 31.74"

Longitude: 98° 23' 27.34"

A3 RRC Permit #s : 884585, 884586, 884606, 884611, 884612

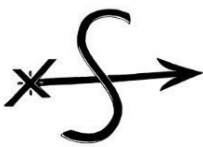


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1. EMERGENCY ASSISTANCE TELEPHONE LIST

1.1 Public Safety

Arrow S Energy Operating, LLC Emergency Number	1000 Louisiana, Suite 7000 Houston, TX 77002	(713) 400-6648 (405) 219-1076
Atascosa EMS	915 Main Street Jourdanon, TX 78026	911 (830) 769-2702
Atascosa County Sheriff Office	1108 Campbell Ave, Jourdanon, TX 78026	(830) 769-3434
Volunteer Fire Department	108 2nd St, Pleasanton, TX 78064	(830) 569-2813
Methodist Hospital Atascosa	1905 Hwy 97 East, Jourdanon, TX 78026	(830) 769-3515
Drilling Superintendent	Gary Patchin	(601) 416-7366
Drilling Consultant		
Drilling Consultant		
ASEO HSE Manager/ Emergency Response Coordinator	Antonio Lopez	(832) 572-9180
Arrow S Ranch Manager	Rocky Roberts	(830) 570-7361
Well Control	Wild Well Control	(281) 784-4700
Texas Dept. of Transportation:	2154 S. Second St. Pleasanton, TX 78064	(830) 281-5384
NACG / SMEC Control Room 24/7/365		(830) 784-3411 Ext 239
NACG / SMEC	Brian Young Safety Manager	(830) 480-0036
Texas Railroad Commission:	Main Line	(887) 228-5740
	24hr. Accident Reporting	(512) 463-6788
		(432) 345-2499 (432) 445-4737



2. H₂S CONTINGENCY PLAN

2.1 Scope:

This H₂S Contingency Plan (the Plan) provides an organized plan of action for alerting and protecting workers and the public within an area of exposure prior to an intentional release or following the accidental release of a potentially hazardous volume of hydrogen sulfide. The plan establishes guidelines for affected residents and personnel whose dwelling(s) or work activity may be at risk of exposure to Hydrogen Sulfide Gas (H₂S).

2.2 Objective:

- Prevent any and all accidents and prevent the uncontrolled release of H₂S into the atmosphere.
- Provide proper evacuation procedures to cope with emergencies.
- Provide immediate and adequate medical attention should an injury occur.

2.3 Purpose, Distribution and Updating of This Plan:

The Purpose of this H₂S Contingency Plan is to protect workers and the general public from the harmful effects of H₂S accidentally escaping from the subject producing well. This plan is designed to accomplish its purpose by assuring the preparedness necessary to:

1. Minimize the possibility of releasing H₂S into the atmosphere during related
2. operations.
Provide for the logical, efficient, and safe emergency actions required to protect the general

Supplemental information is included with this plan and is intended as reference material for anyone needing a more detailed understanding of the many factors pertinent to safe H₂S operations. Although the release of a potentially hazardous quantity of H₂S is highly unlikely, if such a release should occur however, obviously the exact time, rate, duration, and other pertinent facts will be known in advance thus, this plan must necessarily be somewhat general. The plan does review in detail, as is reasonably possible, the type of accidental release that could possibly endanger the general public, the probable extent of such danger, and the emergency actions generally appropriate. In the event of such an accidental release, the specific actions to be taken will have to be determined at the time of release by the responsible personnel at the well site. Complete familiarity with this plan will help such personnel make the proper decisions rapidly. Familiarity with this plan is also required of all operators, operator representatives, and drilling contractor supervisory personnel who could possibly be on duty at the drilling location at the time of an H₂S emergency.

This plan must be kept current if it is to effectively serve its purpose. The Arrow S Energy Operating Safety Manager will be responsible for seeing that all copies are updated. Updating the plan is required when any changes to the personnel Call List (Section) including telephone numbers occur or

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when any pertinent data or plans for the well are altered. The plan must also be updated when any changes in the general public likely to be within the exposure area in the event of an accidental release from the well bore of a potentially hazardous quantity of H₂S. This plan shall be made available at the Pleasanton Field Office, WellDrive HSE Folder/H₂S, and one printed copy shall be retained at the drilling location.

3. DEFINITIONS

TLV: Threshold Limit Value is the concentration employees may be exposed based on a TWA (time weighted average) for eight (8) hours in one day for 40 hours in one (1) week. This is set by ACGIH (American Conference of Governmental Hygienists) and regulated by OSHA.

STEL: Short Term Exposure Limit is the 15-minute average concentration an employee may be exposed H₂S.

IDLH: Immediately Dangerous to Life and Health is the concentration that has been determined by the ACGIH to cause serious health problems or death if exposed to this level. The IDLH for H₂S is 100 parts per million (PPM).

TWA: Time Weighted Average is the average concentration of any chemical or gas for an eight (8) hour period. This is the concentration that any employee may be exposed based on a TWA.

PPM: Parts Per Million is the ratio of one gas to another .

4. AFFECTED PUBLIC

4.1 Area Residences/ Occupied Locations/ Public Roads

Resident Location	Resident Name	Phone Number	Email Address
NONE			
No residents located in the Radius of Exposure (ROE)			

Public Roadway			
NONE			
No public roadways located within the Radius of Exposure (ROE)			

Occupied Location	Contact Name	Phone Number	Email Address
NONE			
No occupied locations located within the Radius of Exposure (ROE)			

5. OPERATING CONDITIONS

5.1 Conditions Requiring Air Masks

- Whenever air masks are used, the person should be appropriately shaven to allow for a tight fit and seal of the breathing equipment.
- When breaking out any line where H₂S can reasonably be expected.
- When sampling air in areas to determine if toxic concentrations of H₂S exist.

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- When working in areas where 10 PPM or more of H₂S has been
- detected.

5.2 Toxic Effects of H₂S Poisoning

Hydrogen Sulfide is extremely toxic. The acceptable ceiling concentration for eight-hour exposure is 10 PPM, which is .001% by volume. Hydrogen Sulfide is heavier than air (specific gravity – 1.192) and is colorless and transparent. Hydrogen Sulfide is almost as toxic as Hydrogen Cyanide and is 5-6 times more toxic than Carbon Monoxide. Occupational exposure limits for Hydrogen Sulfide and other gases are compared below in

5.3 Toxicity table for H₂S *(Adapted from ACGIH and NIOSH sources)*

Concentration (PPM)	Physiological Effect
0.1 - 3	Oder Threshold
3 - 10	Offensive Oder
10 - 50	Headache Nausea Throat and Eye Irritation
50 - 100	Eye Injury
100 - 300	Conjunctivitis Respiratory Tract Infection Olfactory Paralysis
300 - 500	Pulmonary Edema Imminent Threat to Life
500 - 1,000	Strong Nervous System Stimulation Apnea
1,000 – 2,000	Immediate Collapse with Respiratory Paralysis Risk of Death

5.4 Permissible Exposure Limits of H₂S Gases

Percent %	PPM	Physical Effects
.0001	1	Can smell less than 1 ppm.
.001	10	TLV for 8 hours of exposure.
.0015	15	STEL for 15 minutes of exposure.
.01	100	Immediately Dangerous to Life & Health. Kills sense of smell in 3 to 5 minutes.
.02	200	Kills sense of smell quickly, may burn eyes and throat.
.05	500	Dizziness, cessation of breathing begins in a few minutes .
.07	700	Unconscious quickly, death will result if not rescued promptly.
.10	1000	Death will result unless rescued promptly. Artificial resuscitation may be necessary.



5.5 Permissible Exposure Limits of Various Gases

Common Name	Symbol	Sp. Gravity	TLV	STEL	IDLH
Hydrogen Cyanide	HCN	.94	4.7 ppm	4.7 ppm	50 ppm
Sulfide Dioxide	SO ₂	2.21	2 ppm	5 ppm	100 ppm
Chlorine	CL	2.45	.5 ppm	1 ppm	10 ppm
Carbon Monoxide	CO	.97	25 ppm	200 ppm	1200 ppm
Carbon Dioxide	CO ₂	1.52	5000 ppm	30,000 ppm	40,000 ppm
Methane	CH ₄	.55	5% LEL	15% UEL	

5.6 Physical Properties of H₂S:

- **COLOR – TRANSPARENT:** Hydrogen Sulfide is colorless, so it is invisible. This fact simply means that you can't rely on your eyes to detect its presence. In fact, that makes this gas extremely dangerous to be around.
- **ODOR – ROTTEN EGGS:** Hydrogen Sulfide has a distinctive offensive smell, like "rotten eggs". For this reason, it earned its common name "sour gas". However, H₂S, even in low concentrations, is so toxic that it attacks and quickly impairs a victim's sense of smell, so it could be fatal to rely on your nose as a detection device.
- **VAPOR DENSITY – SPECIFIC GRAVITY OF 1.192:** Hydrogen Sulfide is heavier than air, so it tends to settle in low-lying areas like pits, cellars or tanks. If you find yourself in a location where H₂S is known to exist, protect yourself. Whenever possible, work in an area upwind and keep to higher ground.
- **EXPLOSIVE LIMITS – 4.0% TO 44%:** Mixed with the right proportion of air or oxygen, H₂S will ignite and burn or explode, producing another alarming element of danger besides poisoning.
- **FLAMMABILITY** – Hydrogen Sulfide will burn readily with a distinctive clear blue flame, producing Sulfur Dioxide (SO₂), another hazardous gas that irritates the eyes and lungs.
- **SOLUBILITY – 4 TO 1 RATIO WITH WATER:** Hydrogen Sulfide can be dissolved in liquids, which means that it can be present in any container or vessel used to carry or hold well fluids including oil, water, emulsion and sludge. The solubility of H₂S is dependent on temperature and pressure, but if conditions are right, simply agitating a fluid containing H₂S may release the gas into the air.
- **BOILING POINT – (-77° Fahrenheit):** Liquefied Hydrogen Sulfide boils at a very low temperature, so it is usually found as a gas.



6. EVACUATION PLAN

6.1 General Evacuation Plan:

The direct lines of action prepared by Arrow S Energy Operating to protect the public from hazardous gas situations are as follows:

- When the company approved supervisor (Drilling Superintendent) determines that Hydrogen Sulfide gas at 100 PPM or greater cannot be limited to the well location, and the public will be involved, he will activate the evacuation plan. Well site escape routes are noted on the well site area map.
- Appropriate local government agencies will be notified that a hazardous condition exists, and an evacuation alarm has been initiated.
- Company approved safety personnel that have been trained in the use of the proper emergency equipment will be utilized.
- Law enforcement personnel (State Police, Local Police Department, Fire Department, and the Sheriff's Department) will be called to aid in setting up and maintaining roadblocks. Also, they will aid in evacuation of the public if necessary.
- After the discharge of gas has been controlled, the authorized company supervisor will determine when the area is safe for re-entry.
- If a major release is secured, all exposed housing, vehicles, and low-lying areas and other structures downwind must be tested and cleared ensure that all residual H₂S is cleared.
- Fans, or opening of doors is recommended to ensure that enclosed spaces are cleared as part of this process.

***Note:** Law enforcement personnel will not be asked to come into a contaminated area. Their assistance will be limited to uncontaminated areas. Constant radio contact will be maintained with emergency personnel.*

6.2 If uncontrollable condition above 15 ppm occurs, the following will occur:

- Prepare to take steps to protect and/or remove workers and the public downwind of the location, including partial evacuation or isolation as necessary.
- Prepare to notify necessary public safety personnel for help with maintaining roadblocks, thus limiting traffic and implementing evacuation.
- Determine and proceed with the best possible plan to regain control of the well. Maintain tight security and safety measures.

6.3 Responsibility:

- The Company Approved Supervisor (Gary Patchin 601-416-7366) shall be responsible for the total implementation of the plan.
- The Company Approved Supervisor shall be in complete command during any emergency.
- The Company Approved Supervisor has designated backup Supervisors if he/she is not available.



7. EMERGENCY PROCEDURES (100 PPM)

- Before attempting any rescue, you must first get out of the hazardous area yourself. Go to a safe briefing area.
- Sound alarm and activate the 911 system.
- To rescue, put on breathing apparatus. It requires a minimum of two trained rescuers to perform this function.
- Rescue the victim and return them to a safe briefing area.
- Perform an initial assessment and begin proper First Aid/CPR procedures.
- Keep victim lying down with a blanket or coat, etc., under the shoulders to keep airway open. Conserve body heat and do not leave unattended.
- If the eyes are affected by H₂S, wash them thoroughly with potable water. Forslight irritation, cold compresses are helpful.
- In case a person has only minor exposure and does not lose consciousness totally, it's best if he doesn't return to work until the following day.
- Any personnel overcome by H₂S should always be examined by medical personnel. They should always be transported to a hospital or doctor.

7.1 Supervisor & Backup Supervisors:

Drilling Superintendent	Gary Patchin	601-416-7366
Drilling Consultant		

7.2 Actions to be Taken:

- Assign specific tasks to well site personnel
- Evacuate the general public from the exposure area
- Cordon off the exposure area to prevent entry by unauthorized persons
- Request assistance if and as needed and initiate emergency notifications
- Stop the dispersion of H₂S
- Complete emergency notifications as required
- Return the situation to normal

7.3 Evacuation Direction:

- Always evacuate cross and up-wind from the point of gas release. Workers should muster at the most up-wind designated muster points:

8. POST EMERGENCY ACTIONS

In the event this plan is activated, the following post emergency actions shall be taken to reduce the possibility of a reoccurrence of the type of problem that required its activation, and/or assure that any future activation of a similar plan will be as effective as possible.

- Review the factors that caused or permitted the emergency to occur, and if the need

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- is indicated to modify operating, maintenance and/or surveillance procedures.
- If the need is indicated, retrain employees in H₂S emergency procedures etc.
- Clean up, recharge, restock, repair, and/ or replace H₂S emergency equipment as necessary, and return it to its proper place. (For whatever rental equipment is used, this will be the responsibility of Rental Company).
- See that future H₂S Contingency plan is modified as necessary, if the need is

9. WELL IGNITION PROCEDURES

9.1 Responsibilities:

The decision to ignite the well is the responsibility of the authorized company representative in concurrence with the STATE POLICE. In the event the authorized company representative is incapacitated, it becomes the responsibility of the Drilling Consultant. The well should only be ignited only as a last resort and in a situation where it is clear that:

- Human life and property are endangered.
- There is no hope of controlling the blowout under the prevailing

If time permits, notify the main office, but do not delay if human life is in danger. Initiate the first phase of the evacuation plan.

9.2 Instructions for Igniting the Well:

- Two people are required for the actual igniting operation. Both men must wear self-contained breathing apparatus and must use a full body harness and attach a retrievable safety line to the D-Ring in the back. One man must monitor the atmosphere for explosive gases with the LEL monitor, while the Drilling Consultant is responsible for igniting the well.
- The primary method to ignite is a 25mm flare gun with a range of approximately 500 feet.
- Ignite from upwind and do not approach any closer than is warranted.
- Select the ignition site best suited for protection and which offers an easy escape route.
- Before igniting, check for the presence of combustible gases.
- After igniting, continue emergency actions and procedures as before.
- All unassigned personnel will limit their actions to those directed by the authorized company represented.

Note: After the well is ignited, burning Hydrogen Sulfide will convert to Sulfur Dioxide, which is also highly toxic. Also, both are heavier than air. Do not assume the area is safe even after the well is ignited.

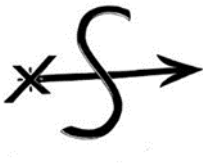
10. TRAINING PROGRAM

When working in an area where Hydrogen Sulfide (H₂S) might be encountered, training requirements must be met. The Company Supervisor will ensure that all personnel at the well site have had adequate training in the following subjects:

- Hazards and characteristics of Hydrogen Sulfide (H₂S).

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- Physicals effects of Hydrogen Sulfide on the human body.
- Toxicity of Hydrogen Sulfide and Sulfur Dioxide.
- H₂S detection, Emergency alarm and sensor location.
- Don and Doff of SCBA and be appropriately shaven.
- Emergency rescue.
- Resuscitators.
- First aid and artificial resuscitation.
- The effects of Hydrogen Sulfide on metals.

Service company personnel and visiting personnel must be notified if the zone contains H₂S, and each service company must provide adequate training and equipment for their employees before they arrive at the well site.

11. EMERGENCY EQUIPMENT

11.1 Lease Entrance Sign:

The lease H₂S entrance warning sign should be placed at the entrance of location and at a minimum provide the following information:

- CAUTION
- H₂S POISONOUS GAS MAY BE PRESENT
- NO ADMITTANCE WITHOUT AUTHORIZATION

Sample H₂S Entrance Sign:





11.2 Respiratory Equipment:

Emergency escape self-contained breathing apparatus shall be available on location.

11.3 Respiratory Equipment:

The Occupational Safety and Health Administration (OSHA) regulate the use of respiratory protection to protect the health of employees. OSHA's requirements are written in the Code of Federal Regulations, Title 29, Part 1910, Section 134, Respiratory Protection. This regulation requires that all employees who might be required to wear respirators, shall complete an OSHA mandated medical evaluation questionnaire. The employee then should be fit tested prior to wearing any respirator while being exposed to hazardous gases.

Written procedures shall be prepared covering safe use of respirators in dangerous atmospheric situations, which might be encountered in normal operations or in emergencies. Personnel shall be familiar with these procedures and the available respirators.

Respirators shall be inspected prior to and after each use to make sure that the respirator has been properly cleaned, disinfected and that the respirator works properly. The unit should be fully charged prior to being used.

Anyone who may use respirators shall be properly trained in how to properly seal the face piece. They shall wear respirators in normal air and then in a test atmosphere. (Note: Such items as facial hair (beard or sideburns) and eyeglass temple pieces will not allow a proper seal.) Anyone who may be expected to wear respirators should have these items removed before entering a toxic atmosphere. A special mask must be obtained for anyone who must wear eyeglasses. Contact lenses should not be allowed.

Respirators shall be worn during the following conditions:

- When breaking out any line where H₂S can reasonably be expected.
- When sampling air in areas where H₂S may be present.
- When working in areas where the concentration of H₂S exceeds the Threshold Limit Value for H₂S (10 ppm).
- At any time where there is a doubt as to the H₂S level in the area to be entered.

11.4 Windsocks or Wind Streamers:

- Two (2) windsocks. A windsock must be visible from all areas of location.

11.5 Hydrogen Sulfide Monitors and Alarms:

There are three (3) H₂S monitors located at the following locations:

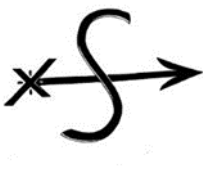
- Cellar
- Drill floor
- Shakers

11.6 H₂S Monitoring System Set Points

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	Alarm Level 1	Alarm Level 2
Sensor Location	Flashing Strobe and Call Out to ASEO Personnel	Flashing Strobe, Siren Alarm, Call Out to ASEO Personnel
Cellar	10 PPM - 99 PPM	100 PPM
Drill Floor	10 PPM - 99 PPM	100 PPM
Shakers	10 PPM - 99 PPM	100 PPM

11.7 Fire Extinguishers:

Fire extinguisher shall be located at the drill floor, cellar and shakers in addition to areas required outside of this H2S Contingency Plan.

11.8 Designated Areas:

- Smoking is not allowed anywhere on the affected location.

11.9 Safe Briefing Areas:

- The designated safe briefing area should be the muster point furthest and most up-wind from the point of release. In the event none of the muster locations are safe, a safe briefing area will be appointed by the company authorized supervisor.
- Personal protective equipment should be stored on location upwind of prevailing winds.

11.10 Checklist:

Equipment Status Check List (all may not apply)	X
Sign at location entrance	
Two (2) windsocks (in required locations)	
Safe Briefing Areas identified as muster points	
Hydrogen Sulfide detection/ alarm system hooked-up & tested	
All support crews and supervisor trained (as required)	
All support crews and supervision medically qualified and fit tested for proper respirators	
Access restricted for unauthorized personnel	
All outside service contractors advised of potential H ₂ S and concentration values	
25mm Flare Gun on location w/flare cartridges	
Two (2) Self Contained Breathing Apparatus.	

11.11 Procedural Check List (all may not apply)

- Inspect fire extinguisher.
- Inspect breathing equipment.
- Make sure all Hydrogen Sulfide detection systems are



12. MAPS, PLATS & APPENDICES

APPENDIX A ROE MAP





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APPENDIX C SITE EMERGENCY NUMBERS

EMERGENCY INFORMATION ARROW S ENERGY OPERATING

ATASCOSA EMS	911
Atascosa County Sheriff EMS Dispatch	(830) 769-3434
Air Life	(210) 233-5800
San Antonio, TX	(800) 247-6428
Poison Control	(800) 222-1222
Nearest Hospital	(830) 769-3515
Methodist Hospital Atascosa	1905 Hwy 97 East, Jourdanton, TX 78026
24 min (23.0 miles) via FM140 W and TX-16 N FM140 Pleasanton, TX 78064 ↑ Head west on FM140 W 12.4 mi ↙ Turn right onto TX-16 N Pass by Subway (on the left in 8.5 mi) 9.0 mi ↙ Turn right onto TX-97 E/Oak St Continue to follow TX-97 E 1.6 mi Methodist Hospital Atascosa 1905 Hwy 97 East, Jourdanton, TX 78026	

LOCATION INFORMATION

Location / Pad Name:	ASE SOUTH PADS A3 & B3	
GPS Coordinates	28 43' 31.74	-98 23' 27.34
Construction:	Jerrold Harris	903-253-2743
Drilling:	Gary Patchin	601-416-7366
Water Management:		
Completions	Trevor Willms	720-891-0045
Production:		
Workover:		
HSE	Antonio Lopez	832- 572-9180
	Richard Bunker	435-253-0716

SAN MIGUEL

SMEC Control Room 24/7/365	830-784-3411 Ext 239
Brian Young Safety Manager – NACG	830-480-0036

DIRECTIONS TO RANCH ACCESS GATE

GPS: 28 43' 31.74 -98 23' 27.34

From: US-281 ALT S & FM 140 W

1. Turn South onto FM 140 W from US 281 ALT S
2. Travel 2.10 Miles South and exit left onto lese road.
3. Travel 0.28 Miles then turn right
4. Travel 0.15 Miles then turn left
5. Travel 0.57 Miles then turn right
6. Travel 0.10 Miles then turn right into location



People First, Safety Always