

# Legacy Reserves Operating LP

H2S Drilling Operations Plan

Lea Unit #33H

Lea County, New Mexico

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## Table of Contents

H2S Contingency Plan Section .....	3
Scope: .....	3
Objective: .....	3
Emergency Procedures Section.....	4
Emergency Procedures.....	4
Emergency Procedure Implementation .....	4
Simulated Blowout Control Drills .....	5
Ignition Procedures .....	8
Responsibility: .....	8
Instructions for Igniting the Well: .....	8
Training Program .....	9
Emergency Equipment Requirements.....	9
CHECK LISTS.....	13
Status Check List.....	13
Procedural Check List .....	13
Briefing Procedures.....	14
Pre-Spud Meeting.....	14
Evacuation Plan .....	15
General Plan .....	15
Emergency Assistance Telephone List.....	15
MAPS AND PLATS .....	16

## **H2S Contingency Plan Section**

### **Scope:**

This contingency plan provides an organized plan of action for alerting and protecting 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 all personnel whose work activity may involve exposure to Hydrogen Sulfide Gas (H<sub>2</sub>S).

### **Objective:**

Prevent any and all accidents, and prevent the uncontrolled release of H<sub>2</sub>S into the atmosphere.

Provide proper evacuation procedures to cope with emergencies.

Provide immediate and adequate medical attention should an injury occur.

**Implementation:** This plan, with all details, is to be fully implemented 1000' before drilling into the first sour zone.

**Emergency Response Procedure:** This section outlines the conditions and denotes steps to be taken in the event of an emergency.

**Emergency Equipment and Procedure:** This section outlines the safety and emergency equipment that will be required for the drilling of this well.

**Training Provisions:** This section outlines the training provisions that must be adhered to 1000' before drilling into the first sour zone.

**Emergency Call Lists:** Included are the telephone numbers of all persons that would need to be contacted, should an H<sub>2</sub>S emergency occur.

**Briefing:** This section deals with the briefing of all persons involved with the drilling of this well.

**Public Safety:** Public safety personnel will be made aware of the drilling of this well.

**Check Lists:** Status check lists and procedural check lists have been included to ensure adherence to the plan.

**General Information:** A general information section has been included to supply support information.

## **Emergency Procedures Section**

### **Emergency Procedures**

- I. In the event of any evidence of H2S level above 10 ppm, take the following steps immediately:**
  - A. Secure breathing apparatus.
  - B. Order non-essential personnel out of the danger zone.
  - C. Take steps to determine if the H2S level can be corrected or suppressed, and if so, proceed with normal operations.
- II. If uncontrollable conditions occur, proceed with the following:**
  - A. Take steps to protect and/or remove any public downwind of the rig, including partial evacuation or isolation. Notify necessary public safety personnel and the New Mexico Oil & Gas of the situation.
  - B. Remove all personnel to the safe briefing area.
  - C. Notify public safety personnel for help with maintaining roadblocks and implementing evacuation.
  - D. Determine and proceed with the best possible plan to regain control of the well. Maintain tight security and safety measures.
- III. Responsibility:**
  - A. The company approved supervisor shall be responsible for the total implementation of the plan.
  - B. The company approved supervisor shall be in complete command during any emergency.
  - C. The company approved supervisor shall designate a backup supervisor in the event that he/she is not available.

### **Emergency Procedure Implementation**

- I. Drilling or Tripping:**
  - A. All Personnel**
    1. When alarm sounds, don escape unit and report to upwind safe briefing area.
    2. Check status of other personnel (buddy system).
    3. Secure breathing apparatus.
    4. Wait for orders from supervisor.
  - B. Drilling Foreman**
    1. Report to the upwind safe briefing area.
    2. Don breathing apparatus and return to the point of release with the Tool pusher of Driller (buddy system).
    3. Determine the concentration of H2S.
    4. Address the situation and take appropriate control measures.
  - C. Tool Pusher**
    1. Report to the upwind safe briefing area.
    2. Don breathing apparatus and return to the point of release with the Drilling Foreman or the Driller (buddy system).

3. Determine the concentration.
  4. Address the situation and take appropriate control measures.
- D. Driller
1. Check the status of other personnel (in a rescue attempt, always use the buddy system).
  2. Assign the least essential person to notify the Drilling Foreman and Tool Pusher, in the event of their absence.
  3. Assume the responsibility of the Drilling Foreman and the Tool Pusher until they arrive, in the event of their absence.
- E. Derrick Man and Floor Hands
1. Remain in the upwind safe briefing area until otherwise instructed by a supervisor.
- F. Mud Engineer
1. Report to the upwind safe briefing area.
  2. When instructed, begin check of mud for PH level and H2S level.
- G. Safety Personnel
1. Don breathing apparatus.
  2. Check the status of all personnel.
  3. Wait for instructions from Drilling Foreman or Tool Pusher.
- II. **Taking a Kick:**
- A. All personnel report to the upwind safe briefing area.
  - B. Follow standard BOP procedures.
- III. **Open Hole Logging:**
- A. All unnecessary personnel should leave the rig floor.
  - B. Drilling Foreman and Safety personnel should monitor the conditions and make necessary safety equipment recommendations.
- IV. **Running Casing or Plugging:**
- A. Follow "Drilling or Tripping" procedures.
  - B. Assure that all personnel have access to protective equipment.

### **Simulated Blowout Control Drills**

All drills will be initiated by activating alarm devices (air horn). One long blast on the air horn for ACTUAL and SIMULATED blowout control drills. This operation will be performed by the Drilling Foreman or Tool Pusher at least one time per week for each of the following conditions, with each crew:

- |          |                     |
|----------|---------------------|
| Drill #1 | On-bottom Drilling  |
| Drill #2 | Tripping Drill Pipe |

In each of these drills, the initial reaction time to shutting in the well shall be timed as well as the total time for the crew to complete its entire put drill assignment. The times must be recorded on the IADC Driller's log as "Blowout Control Drill".

Drill No.:

Reaction Time to Shut-in:

minutes,

seconds.

Total Time to Complete Assignment:

minutes,

seconds.

I. Drill Overviews:

A. Drill No. 1 – On-bottom Drilling

1. Sound the alarm immediately.
2. Stop the rotary and hoist the Kelly joint above the rotary table.
3. Stop the circulatory pump.
4. Close the drill pipe rams.
5. Record casing and drill pipe shut-in pressures and pit volume increases.

B. Drill No. 2 – Tripping Drill Pipe:

1. Sound the alarm immediately.
2. Position the upper tool joint just above the rotary table and set the slips.
3. Install a full opening valve inside blowout preventer tool in order to close the drill pipe.
4. Close the drill pipe rams.
5. Record the shut-in annular pressure.

II. Crew Assignments

A. Drill No. 1 – On-bottom Drilling:

1. Driller

- a) Stop the rotary and hoist the Kelly joint above the rotary table.
- b) Stop the circulatory pump.
- c) Check flow.
- d) If flowing, sound the alarm immediately.
- e) Record the shut-in drill pipe pressure.
- f) Determine the mud weight increase needed or other courses of action.

2. Derrick Man

- a) Open choke line valve at BOP.
- b) Signal Floor Man #1 at accumulator that choke line is open.
- c) Close choke upstream valve after pipe rams have been closed.
- d) Read the shut-in annular pressure and report readings to Driller.

3. Floor Man #1

- a) Close the pipe rams after receiving the signal from the Derrick Man.
- b) Report to Driller for further instructions.

4. Floor Man #2

- a) Notify the Tool Pusher and Operator Representative of the H2S alarms.
- b) Check for open fires and, if safe to do so, extinguish them.
- c) Stop all welding operations.
- d) Turn-off all non-explosive proof lights and instruments.

- e) Report to Driller for further instructions.
- 5. Tool Pusher
  - a) Report to the rig floor.
  - b) Have a meeting with all crews.
  - c) Compile and summarize all information.
  - d) Calculate the proper kill weight.
  - e) Ensure that proper well procedures are put into action.
- 6. Operator Representative
  - a) Notify the Drilling Superintendent.
  - b) Determine if an emergency exists and if so, activate the contingency plan.
- B. Drill No. 2 – Tripping Pipe:
  - 1. Driller
    - a) Sound the alarm immediately when mud volume increase has been detected.
    - b) Position the upper tool joint just above the rotary table and set slips.
    - c) Install a full opening valve or inside blowout preventer tool to close the drill pipe.
    - d) Check flow.
    - e) Record all data reported by the crew.
    - f) Determine the course of action.
  - 2. Derrick Man
    - a) Come down out of derrick.
    - b) Notify Tool Pusher and Operator Representative.
    - c) Check for open fires and, if safe to do so, extinguish them.
    - d) Stop all welding operations.
    - e) Report to Driller for further instructions.
  - 3. Floor Man #1
    - a) Pick up full opening valve or inside blowout preventer tool and slab into tool joint above rotary table (with Floor Man #2)
    - b) Tighten valve with back-up tongs.
    - c) Close pipe rams after signal from Floor Man #2.
    - d) Read accumulator pressure and check for possible high pressure fluid leaks in valves or piping.
    - e) Report to Driller for further instructions.
  - 4. Floor Man #2
    - a) Pick-up full opening valve or inside blowout preventer tool and tab into tool joint above rotary table (with Floor Man #1)
    - b) Position back-up tongs on drill pipe.
    - c) Open choke line valve at BOP.
    - d) Signal Floor Man #1 at accumulator that choke line is open.
    - e) Close choke and upstream valve after pipe rams have been closed.
    - f) Check for leaks on BOP stack and choke manifold.

- g) Read annular pressure.
- h) Report readings to the Driller.
- 5. Tool Pusher
  - a) Report to the rig floor.
  - b) Have a meeting with all of the crews.
  - c) Compile and summarize all information.
  - d) See that proper well kill procedures are put into action.
- 6. Operator Representative
  - a) Notify Drilling Superintendent.
  - b) Determine if an emergency exists, and if so, activate the contingency plan

## **Ignition Procedures**

### **Responsibility:**

The decision to ignite the well is responsibility of the DRILLING FOREMAN in concurrence with the STATE POLICE. In the event of the Drilling Foreman is incapacitated, it becomes the responsibility of the RIG TOOL PUSHER. This decision should be made only as a last resort and in a situation where it is clear that:

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

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.

### **Instructions for Igniting the Well:**

1. 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 Foreman is responsible for igniting the well.
2. The primary method to ignite is a 25mm flare gun with a range of approximately 500 feet.
3. Ignite from upwind and do not approach any closer than is warranted.
4. Select the ignition site best suited for protection and which offers an easy escape route.
5. Before igniting, check for the presence of combustible gases.
6. After igniting, continue emergency actions and procedures as before.
7. All unassigned personnel will limit their actions to those directed by the Drilling Foreman.

NOTE: After the well is ignited, burning Hydrogen Sulfide will convert to Sulfur Dioxide, which is also highly toxic. Do not assume the area is safe after the well is ignited.



## **Training Program**

When working in an area where Hydrogen Sulfide (H<sub>2</sub>S) might be encountered, definite training requirements for all personnel must be carried out. The Company Supervisor will ensure that all personnel at the well site have had adequate training in the following:

1. Hazards and Characteristics of Hydrogen Sulfide.
2. Physicals effects of Hydrogen Sulfide on the human body.
3. Toxicity of Hydrogen Sulfide and Sulfur Dioxide.
4. H<sub>2</sub>S detection, emergency alarm and sensor location.
5. Emergency rescue.
6. Resuscitators.
7. First aid and artificial resuscitation.
8. The effects of Hydrogen Sulfide on metals.
9. Location safety.

Service company personnel and visiting personnel must be notified if the zone contains H<sub>2</sub>S, and each service company must provide adequate training and equipment for their employees before they arrive at the well site.

## **Emergency Equipment Requirements**

### **Lease Entrance Sign:**

Should be located at the lease entrance with the following information:

CAUTION- POTENTIAL POISON GAS HYDROGEN SULFIDE

### **Well Control Equipment:**

- A flare line will be located a minimum of 150' from the wellhead to be ignited by a flare gun.
- The choke manifold will include a remotely operated choke.
- A mud/gas separator will be installed to separate gas from the drilling mud.

### **Mud Program:**

The drilling mud program has been designed to minimize the volume of hydrogen sulfide (H<sub>2</sub>S) circulated to surface. The operator will have the necessary mud products on location to minimize the hazards while drilling in H<sub>2</sub>S-bearing zones.

**Metallurgy:**

- All drill strings , casings, tubing, wellhead equipment , the blowout preventer , the drilling spool, kill lines, choke manifold and lines, and all valves shall be suitable for H<sub>2</sub>S service.
- All elastomers used for packing and seals shall be H<sub>2</sub>S trim.

**Respiratory Equipment:**

- Fresh air breathing equipment should be placed at the safe briefing areas and should include the following: Two SCBA's will be placed at each briefing area. A moveable breathing air trailer with 2 SCBA's, 5 work/escape units, ample breathing air hose and manifolds will be on location. The breathing air hose will be installed on the rig floor and derrick along with breathing air manifolds so that it will not restrict work activity. All employees that may wear respiratory will complete a MEQ and be quantitative fit tested 1000' prior to the 1st zone that may contain H<sub>2</sub>S.

**Windssocks or Wind Streamers:**

- A minimum of two 10" windssocks located at strategic locations so that they may be seen from any point on location. More will be used if necessary for wind consciousness.
- Wind streamers (if preferred) should be placed at various locations on the well site to ensure wind consciousness at all times. (Corners of location).

**Hydrogen Sulfide Detector and Alarms:**

- 1 - Four channel H<sub>2</sub>S monitor with audible and visual alarms, strategically located to be seen and heard by all employees working on the well site. All sensors will be bump tested or calibrated if necessary on a weekly basis. The alarms will be set to visually alarm at 10 PPM and audible at 14 PPM.
- Four (4) sensors located as follows: #1 -Rig Floor, #2 & #3- Bell Nipple, #4- End of flow line where wellbore fluid is discharged.
- Portable color metric tube detector with tubes will be stored in the Tool Pusher trailer.

**Well Condition Sign and Flags:**

The Well Condition Sign with flags should be placed a minimum of 150' before entry to the location. It should have three (3) color coded flags (green, yellow and red) that will be used to denote the following location conditions:

GREEN - Normal Operating Conditions

YELLOW - Potential Danger

RED - Danger, H<sub>2</sub>S Gas Present

**Auxiliary Rescue Equipment:**

- Stretcher (drilling contractor)
- 2- 100' OSHA approved Rescue lines (drilling contractor)
- First Aid Kit properly stocked (drilling contractor)

**Mud Inspection Equipment:**

Garret Gas Train or Hach Tester for inspection of Hydrogen Sulfide in the drilling mud system.

**Fire Extinguishers:**

Adequate fire extinguishers shall be located at strategic locations (provided by drilling contractor)

**Blowout Preventer:**

- The well shall have hydraulic BOP equipment for the anticipated BHP.
- The BOP should be tested upon installation.
- BOP, Choke Line and Kill Line will be tested as specified by Operator.

**Confined Space Monitor:**

There should be a portable multi-gas monitor with at least 3 sensors (O<sub>2</sub>, LEL & H<sub>2</sub>S). This instrument should be used to test the atmosphere of any confined space before entering. It should also be used for atmospheric testing for LEL gas before beginning any type of Hot Work. Proper calibration documentation will need to be provided. (Supplied by Drilling Contractor)

**Communication Equipment:**

- Proper communication equipment such as cell phones or 2 -way radios should be available at the rig.
- Radio communication shall be available for communication between the company man's trailer, rig floor and the tool pusher's trailer.
- Communication equipment shall be available on the vehicles.

**Special Control Equipment:**

- Hydraulic BOP equipment with remote control on the ground.
- Rotating head at the surface casing point.
- BOP, Choke Manifold and Process Flow Diagrams (see the attached - previously submitted)
- Patriot Rig #5 SM Choke Manifold Equipment (see the attached - previously submitted)

**Evacuation Plan:**

- Evacuation routes should be established prior to spudding the well.
- Should be discussed with all rig personnel.

**Designated Areas:*****Parking and Visitor area:***

- All vehicles are to be parked at a pre-determined safe distance from the wellhead.
- Designated smoking area.

***Safe Briefing Areas:***

- Two safe briefing Areas shall be designated on either side of the location at the maximum allowable distance from the well bore so they offset prevailing winds or they are at a 180 degree angle if wind directions tend to shift in the area.
- Personal protective equipment should be stored at both briefing areas or if a moveable cascade trailer is used, it should be kept upwind of existing winds. When wind is from the prevailing direction, both briefing areas should be accessible.

**NOTES:**

- Additional equipment will be available at the Read and Stevens, Inc. Rowsell, New Mexico office.
- Additional personal H2S monitors are available for all employees on location.
- Automatic Flare Igniters are recommended for installation on the rig.

## **CHECK LISTS**

### **Status Check List**

Note: Date each item as they are implemented.

1. Sign at location entrance.
2. Two (2) wind socks (in required locations).
3. Wind Streamers (if required).
4. SCBA's on location for all rig personnel and mud loggers.
5. Air packs, inspected and ready for use.
6. Spare bottles for each air pack (if required).
7. Cascade system for refilling air bottles.
8. Cascade system and hose line hook up.
9. Choke manifold hooked-up and tested. (Before drilling out surface casing.)
10. Remote Hydraulic BOP control (hooked-up and tested before drilling out surface casing).
11. BOP tested (before drilling out surface casing).
12. Mud engineer on location with equipment to test mud for H<sub>2</sub>S.
13. Safe Briefing Areas set-up.
14. Well Condition sign and flags on location and ready.
15. Hydrogen Sulfide detection system hooked-up & tested.
16. Hydrogen Sulfide alarm system hooked-up & tested.
17. Stretcher on location at Safe Briefing Area.
18. 2-100' OSHA Approved Life Lines on location.
19. 1-20# Fire Extinguisher in safety trailer.
20. Confined Space Monitor on location and tested.
21. All rig crews and supervisor trained (as required).
22. Access restricted for unauthorized personnel.
23. Drills on H<sub>2</sub>S and well control procedures.
24. All outside service contractors advised of potential H<sub>2</sub>S on the well.
25. NO SMOKING sign posted.
26. H<sub>2</sub>S Detector Pump w/tubes on location.
27. 25mm Flare Gun on location w/flares.
28. Automatic Flare Igniter installed on rig.

### **Procedural Check List**

Perform the following on each tour:

1. Check fire extinguishers to see that they have the proper charge.
2. Check breathing equipment to insure that they have not been tampered with.
3. Check pressure on the supply air bottles to make sure they are capable of recharging.
4. Make sure all of the Hydrogen Sulfide detection systems are operative.

Perform the following each week:

1. Check each piece of breathing equipment to make sure that they are fully charged and operational. This requires that the air cylinder be opened and the mask assembly be put on and tested to make sure that the regulators and masks are properly working. Negative and positive pressure should be conducted on all masks.
2. BOP skills.
3. Check supply pressure on BOP accumulator stand-by source.
4. Check all breathing air mask assemblies to see that straps are loosened and turned back, ready to use.
5. Check pressure on cascade air cylinders to make sure they are fully charged and ready to use for refill purposes if necessary.
6. Check all cascade system regulators to make sure they work properly.
7. Perform breathing drills with on-site personnel.
8. Check the following supplies for availability:
  - Stretcher
  - Safety Belts and ropes.
  - Spare air bottles.
  - Spare oxygen bottles (if resuscitator required).
  - Gas Detector Pump and tubes.
  - Emergency telephone lists.
9. Test the Confined Space Monitor to verify the batteries are good and that the unit is in good working condition and has been properly calibrated according to manufacturer's recommendations.

## **Briefing Procedures**

The following scheduled briefings will be held to ensure the effective drilling and operation of this project:

### **Pre-Spud Meeting**

Date: Prior to spudding the well.

Attendance: Drilling Supervisor  
Drilling Engineer  
Drilling Foreman  
Rig Tool Pushers  
Mud Engineer  
All Safety Personnel  
Key Service Company Personnel

Purpose: Review and discuss the well program, step-by-step, to ensure complete understanding of assignments and responsibilities.

## Evacuation Plan

### General Plan

The direct lines of action prepared by MOJO SAFETY, to protect the public from hazardous gas situations are as follows:

1. When the company approved supervisor (Drilling Foremen, Tool Pusher or Driller) determine that Hydrogen Sulfide gas cannot be limited to the well location, and the public will be involved, he will activate the evacuation plan. Escape routes are noted on the Area Map.
2. Company safety personnel or designee will notify the appropriate local government agency that a hazardous condition exists and evacuation needs to be implemented.
3. Company approved safety personnel that have been trained in the use of the proper emergency equipment will be utilized.
4. 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 road blocks. Also, they will aid in evacuation of the public if necessary.

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 them.

5. After the discharge of gas has been controlled, "Company" safety personnel will determine when the area is safe for re-entry.

### Emergency Assistance Telephone List

#### **PUBLIC SAFETY:** 911 or

Lea County Sheriff or Police .....	(575) 396-3611
Fire Department.....	(575) 397-9308
Hospital.....	(575) 492-5000
Ambulance.....	911
Department of Public Safety .....	(392) 392-5588
Oil Conservation Division .....	(575) 748-1823
New Mexico Energy, Minerals & Natural Resources Department .....	(575) 748-1283

**MOJO Directional LLC:**

MOJO Directional LLC Office ..... (877) 446-6656

Project Manager: Joel Stockford

Office ..... (877) 446-6656

Cell ..... (972) 835-3349

Project Manager: Steve Morris

Office ..... (877) 446-6656

Cell ..... (972) 835-3315

The geologic zones that will be encountered during drilling may contain hazardous quantities of H<sub>2</sub>S. The accompanying map illustrates the affected areas of the community. The residents within this radius will be notified via a hand delivered written notice describing the activities, potential hazards, and conditions of evacuation, evacuation drill siren alarms and other precautionary measures.

Evacuee Description:

Residents: THERE ARE NO RESIDENTS WITHIN 3000' ROE.

**Notification Process:**

A continuous siren audible to all residence will be activated, signaling evacuation of previously notified and informed residents.

**Evacuation Plan:**

All evacuees will migrate laterally toward the wind direction.

Read and Stevens, Inc. will identify all home bound or highly susceptible individuals and make special evacuation preparations, interfacing with the local and emergency medical service as necessary.

**MAPS AND PLATS**

See the attached map showing the 3000' ROE clarification.



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