



HYDROGEN SULFIDE CONTINGENCY PLAN

Anadarko Petroleum

For Drilling Operations

Prospect Name: "RAPTOR"

Desoto Canyon Block

OCS-G-23520 Well No. 1

Rig: Ensco 8506

April, 22 2013

This plan is subject to updating

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I. INTRODUCTION

This plan specifies precautionary measures, safety equipment, emergency procedures, responsibilities, and duties pertaining to Anadarko Petroleum Corporation Drilling operations. **The well is designated as H₂S unknown at 22,686' TVD; therefore, the plan will be instituted and in compliance at 21,186' TVD.**

This plan was developed because of the potential hazards involved when performing operations in formations that may contain hydrogen sulfide (H₂S). It was written in compliance with the rules and regulations of the Bureau of Safety and Environmental Enforcement (BSEE).

To be effective, this plan requires the cooperation and effort of each individual participating in the Drilling of a potential H₂S well. Each individual should know his responsibilities and duties in regard to normal operations and emergency procedures.

He should thoroughly understand and be able to use, at a moments notice, all safety equipment on board the Rig. He should familiarize himself with the location of all safety equipment and see that his equipment is properly stored, easily accessible, and routinely maintained.

Anadarko will make every effort to provide adequate safeguards against harm to persons both on location and in the immediate vicinity from the effects of hydrogen sulfide if released into the atmosphere. The ideas and suggestions of each individual involved in the Drilling of a potential sour gas well are highly welcomed and are an asset for providing the safest working conditions possible.

II. SAFETY EQUIPMENT

A summary of procedures and equipment that will be operational upon reaching the compliance depth is as follows:

A. SAFE BRIEFING AREAS

Two areas will be designated as "SAFE BRIEFING AREAS". There will be Primary (Heliport) and Secondary (Forward Lifeboats) Briefing Areas. If the Primary Area cannot be used due to wind conditions, the Secondary Area will be used. Drawings of the Rig are included in the Appendix.

B. WIND DIRECTION INDICATORS

Windsocks and streamers will be installed on the Rig. They will be positioned as to be seen from any location on the main deck, Rig floor, & heliport.

C. DANGER SIGNS

4' x 8' operational danger signs will be displayed from all sides of the Rig in a manner visible to watercraft and aircraft. The signs for Conditions I, II, and III will be yellow with the following warning painted in 12" high black, block lettering.

**DANGER POISONOUS GAS
HYDROGEN SULFIDE
DO NOT APPROACH IF RED LIGHTS ARE FLASHING**

Signs are worded, as per regulation, red flags will not be used, red lights will. If the H₂S concentration exceeds 10ppm at the surface, red lights will be flashing visible to marine traffic, aircraft, & personnel on the Rig. All personnel working in the hazard area will don SCBA's until concentrations are checked and fall below 10ppm. All signs will be illuminated under conditions of poor visibility and at night. Posters will be displayed indicating the safe briefing areas and Condition I, II, and III signals.

Posters will be located in the following areas:

1. Each Level of the Living Quarters
2. Rig Floor
3. Mud Pit Area
4. Engine Room
5. Work Areas on the Main Deck
6. Mud Pump Area
7. Shale Shaker Area

D. H2S DETECTORS AND ALARMS

The Rig's permanent H2S Detection System will be utilized and the following list of 18 H2S Sensors will be tested once every 24 hours when drilling. Functional testing will begin before the bit is 1,500 feet (vertically) above the potential H₂ S zone.

Continuous monitoring type H₂S detectors, capable of sensing a minimum of 10 ppm H₂S in air, will be located in the proximity of each of the following points:

| | |
|--------|--|
| H2S001 | Fourth Floor AHU Intake - Living Qtrs. |
| H2S002 | Third Floor AHU Intake - Living Qtrs. |
| H2S003 | Second Floor AHU Intake - Living Qtrs. |
| H2S004 | First Floor AHU Intake - Living Qtrs. |
| H2S005 | Galley AHU Intake |
| H2S006 | Drill Floor (Standpipe Manifold) |
| H2S007 | Drillers Cabin (By Drawworks) |
| H2S008 | Mud Gas Separator |
| H2S009 | Flow Line Primer (Gumbo Box) |
| H2S010 | Engine Room Intake (Pipe Deck) |
| H2S011 | Mud Pump Room Intake |
| H2S014 | Mud Pits (Pit 2) |
| H2S015 | Mud Pits (Pit 7) |
| H2S016 | Shale Shakers |
| H2S017 | De-sander/De-silter |
| H2S018 | Above Shale Shakers |
| H2S020 | Well Center AFT (Main Deck Moon Pool) |
| H2S022 | Well Center FWD (Main Deck Moon Pool) |

All detectors listed above will be tested, with the splash guard in place, once every 24 hours once the H₂S plan goes into effect. If the results of any functional test are not within 2 ppm or 10 percent, whichever is greater, of the applied concentration, recalibrate the instrument.

Note: The splash guard will be visually inspected daily and cleaned or replaced as necessary.

Once the H₂S Plan goes into effect, the 5 Gas Detectors listed below will be maintained and calibrated once every 7 Days.

| | |
|--------|-------------------------------------|
| H2S012 | Port Aft Column Air Intake |
| H2S013 | Starboard Aft Column Air Intake |
| H2S019 | Port Forward Column Air Intake |
| H2S021 | Starboard Forward Column Air Intake |
| H2S023 | Barge Control Room Air Intake |

Automatic H₂S alarms will be located in the proximity of the following:

1. Rig Floor Work Area
2. Shale Shaker Area
3. Mud Pit Area
4. Mud Pump Room Area
5. Engine Room Area
6. Quarters Area

E. FLARE LINE PIPING

Prior to opening the well bore the degasser and the mud-gas separator will be rigged so the gas can be flared if H₂S is encountered in concentrations equal to, or exceeding, 20 ppm. A flare boom system will be installed to allow safely burning of any H₂S gas being vented. A remote electronic ignition device will be available along with an alternate backup method for igniting the flare igniter. The flare outlet will be a diameter that allows easy non-restricted flow of gas. Personnel will follow SO₂ precautionary measures for 2ppm and 5ppm action levels as described in Section XII. SO₂ monitor readings will be taken using a portable instrument on an hourly basis and logged in reports. (See Duties and Responsibilities SO₂ Section XII).

F. H₂S SERVICE EQUIPMENT

The blowout preventers, integral choke and kill lines, and surface manifold are designed for H₂S service in case it becomes necessary to circulate out a kick.

All equipment will conform to NACE requirements (H₂S resistant materials as per 30 CFR 250.490.

G. H₂S SCAVENGERS

A supply of zinc carbonate, or an equivalent, will be stored aboard the Rig in case the mud becomes contaminated with H₂S. A detailed mud treating procedure is given in Section A-3 of the Appendix. Upon entering the well bore, a sufficient volume of zinc carbonate or equivalent will be maintained aboard the Rig to treat the entire system twice with two pounds per barrel. **In water-base well-control fluids and if ambient air sensors detect H₂S you must immediately conduct either the Garrett-Gas-Train test or comparable test for soluble sulfides to confirm the presence of H₂S.**

H. BREATHING AIR CASCADES AND/OR MANIFOLDS

There will be cascades of high pressure breathing air or manifolds located at each of the following areas:

These bottles are labeled "Safe Breathing Air"

1. Primary and Secondary Safe Briefing Area
2. Shaker House Area
3. Cementing Area
4. Sack Storage Area
5. Rig Floor
6. Logging Unit/MWD Unit
7. Pump Room
8. Pit Room

The Rig cascades are manifolded together to supply breathing air to quick connection manifolds at the Safe Briefing Areas, shale shaker area, mud logging unit, engine room, cementing unit, sack storage area, pump room, mud pit area, Rig floor, derrick, and other work areas, as needed. There will also be SCBA's issued to attending vessels that come along side an H₂S location, as necessary. All vessels will make optimum use of staying upwind during H₂S operations. A Breathing air compressor will be located at the Primary Briefing Area for refill. All Skid units (compressor) will be grounded. All Breathing air equipment will meet ANSI standards.

I. LIST OF SAFETY EQUIPMENT

Marker boards and/or note pads will be located on the Rig floor, in shale shaker area and in the cement pump room. Bullhorn, Flashing Lights, Safety Litter, First aid kit, resuscitators, and safety harness will be kept in the Rig's safety office or Totals' gang box or with the H₂S Technician. The quantity of all safety equipment (including breathing air equipment, resuscitators, H₂S and SO₂ detectors, and explosion meters, flare guns, etc.) are listed in Section C of the Appendix.

J. METALLURGICAL PROPERTIES OF EQUIPMENT

When operating in a zone with H₂S present, equipment will be used that is constructed of materials with metallurgical properties that resist or prevent sulfide stress cracking, chloride stress cracking, hydrogen induced cracking and other failure modes. The following will be in effect:

1. Use tubulars and other equipment, casing, tubing, drill pipe, couplings, flanges, and related equipment that are designed for H₂S service.
2. Use BOP system components, wellhead, pressure-control equipment, and related equipment exposed to H₂S bearing fluids that conform to NACE Standard MR. 01-75-03.
3. Use temporary downhole well security devices such as retrievable packers and bridge plugs that are designed for H₂S service.
4. When producing in zones bearing H₂S, use equipment constructed

- of materials capable of resisting or preventing sulfide stress cracking.
5. Keep the use of WELDING to a minimum during the installation or modification of a production facility. Welding must be done in a manner that ensures resistance to sulfide stress cracking.
 6. An effective means will be used for monitoring and controlling corrosion caused by acid gases (H₂S) and (CO₂) in both the downhole and surface portions of a production system.
 7. Wireline lubricators which may be exposed to fluids containing H₂S must be of H₂S resistant materials.
 8. Gas containing H₂S will not be used for instrument gas unless prior approval is granted by the District Supervisor of the BSEE.
 9. Metals used for sensing lines and safety control devices which are necessarily exposed to H₂S bearing fluids must be constructed of H₂S corrosion resistant materials or coated so as to resist H₂S corrosion.
 10. H₂S resistant materials will be used for all elastomer seals.
 11. If you dispose of produced water by means other than subsurface injection, you must submit to the District Supervisor an analysis of the anticipated H₂S content of the water at the final treatment vessel and at the discharge point. The District Supervisor may require that the water be treated for removal of H₂S and require the submittal of an updated analysis if the water disposal rate or the potential H₂S content increases.
 12. Precautions will be taken to eliminate sealed voids in piping designs, such as slip on flanges, reinforcing pads which can be invaded by atomic hydrogen when H₂S is present.

K. FANS

Ventilation devices will be provided by the rig company, in work areas, as needed. Devices will be capable of dispersing H₂S or SO₂ vapors away from working personnel. Ventilation devices will be explosion proof.

L. FORCED AIR CONTROL SWITCH

All forced air systems will be shut down upon detection of H₂S. (Mud logging unit, Quarters, and any other forced air control switches should be shut off.)

III. NORMAL OPERATING PROCEDURES

This H₂S Contingency Plan will be operational prior to the compliance depth.

1. Lists of emergency phone numbers will be sent to the Rig and should be posted at the following locations: Anadarko Company Representative's office, Contractor's office, Rig Clerk's office, Support Vessels, and Shore base Dispatcher's office; As well as the Drilling Superintendent's office in The Woodlands, TX.
2. All safety equipment and H₂S related hardware must be set up as outlined under Section II "Safety Equipment". All safety equipment must be inspected routinely, paying particular attention to resuscitators and breathing air equipment. SCBA's will be pressure-demand-type with hose line capability rated for at least 30 minute duration.
3. All personnel on board will be assigned breathing air equipment. Anadarko Company and Rig contractor personnel required to work in the following areas will be provided with work/escape type air line equipment with 5-minute escape duration. These units are in addition to their assigned 30-minute rated units.
 - a. Rig Floor
 - b. Mud Pit Area
 - c. Mud Pump Room
 - d. Sack Storage Area
 - e. Cementing Area
 - f. Engine Room
 - g. Monkey Board
 - h. Shale Shaker Area
4. Prior to reaching the H₂S compliance depth, the Rig contractor personnel, Anadarko Company personnel, and necessary service company personnel must be thoroughly trained in the use of breathing air equipment, emergency procedures, responsibilities, and first aid for H₂S victims. Visitors will be given a supplemental briefing if they hold an H₂S card valid for one year and the card is in date. However, if the visitor stays more than 24 hours then full H₂S training and "walk through drill" with instruction will be given to the visitor. An explanation of these drills and training sessions and a list of what they should include are given in Section B-2, B-3, & B-4 of the Appendix. These drills will continue every 7 days even after the Rig personnel become proficient. The H₂S Safety Technician must keep a list of all who have been through the special training programs on board the Rig.
5. Prior to opening the well bore, the H₂S gas detection system will be tested every 24 hours. The time and results of each test will be logged by the H₂S Technician and reported each day to the Anadarko Company Representative. The H₂S Technician will insure that the H₂S detection equipment calibrations and tests are recorded on the IADC Daily Drilling Report Form and Morning Report, by submitting them to the driller to record. In the event that an H₂S detector does not test successfully, operations will cease until (1) the detector is repaired.
6. When boarding the Rig from either boat or helicopter, all personnel, without

exception, must proceed directly to the H2S Safety Technician for assignment of breathing air equipment and, if needed H2S detection equipment. **An instruction and orientation briefing will also be held, if needed (See section on training requirements).** The H2S Safety Technician will be responsible for assigning equipment to the individuals and instructing them in its use.

7. Each person aboard the Rig will be instructed in the use of breathing air equipment until supervisory personnel are satisfied that each is capable of using the equipment. The training must include all additional personnel that are allowed aboard the Rig during drilling operations.
After familiarization, each on-duty Rig and roustabout crew must perform a weekly drill with breathing equipment. The drill may include getting the breathing air equipment, putting it on, and working for a short period. A record should be kept of the crews drilled and the date. A complete "BREATHING AIR EQUIPMENT DRILL" procedure is in Section B-2 & 3.
8. Rig crews and service company personnel should be aware of the location of spare breathing air bottles, resuscitation equipment, portable fire extinguishers, and H2S detectors. Knowledge of the location of H2S detector monitors is vital to understanding the "emergency conditions". In addition, key personnel must be trained in the use of the resuscitator and H2S detection equipment.
9. H2S detection equipment shall be available for use by all working personnel. After H2S has been initially detected by any device, periodic inspections of all areas of poor ventilation shall be made with a portable H2S detector instrument.
10. All personnel on the location shall become "wind-conscious" and be aware of the direction of the prevailing winds at all times. They should remember that H2S is heavier than air and will collect in low places in still air.
11. There shall be no welding, if H2S is detected at the surface, until the surrounding air is thoroughly tested with an explosion meter. Field welding on casing is prohibited unless approved by the BSEE District Supervisor.
12. After penetration of an H2S bearing zone, increased monitoring of the working area should be provided when drilling, circulating bottoms-up from a drilling break, cementing, logging, or circulating while not drilling. If the H2S concentration reaches 10 ppm in the air, breathing air equipment will be worn by all working personnel, and all personnel not assigned emergency duties should go to the appropriate assembly area as listed in section IV and V under conditions II and III.

IV. OPERATING CONDITIONS: Classifications

A. POSSIBLE HAZARDOUS CONDITIONS (H₂S Not Present)

1. Warning Signs (for notification of general public):
2. Alarm (for notification of Rig crew): None
3. Characterized By: Drilling operations under control. Routine operations in zones that may contain hydrogen sulfide. This condition will be in effect continuously to total depth unless it is necessary to go to a Condition I, II, or III.
4. General Action:
 - a. Be alert for a condition change.
 - b. Keep all safety equipment available and monitors functioning properly.
 - c. Perform all drills for familiarization and proficiency.

B. CONDITION I: Potential Danger to Life **H₂S Present at 5 to 9 PPM**

1. Warning Sign:

DANGER POISONOUS GAS
HYDROGEN SULFIDE
DO NOT APPROACH IF RED LIGHTS ARE FLASHING

Signs on all sides of Rig (yellow with black lettering to be visible at night)

2. Alarm: A pinpoint alarm will activate showing concentration and location of H₂S gas.
Work Areas: Red FLASHING LIGHT and constant siren. Alarm signals will activate after a 2 minute delay and will continue as long as the H₂S concentration is present at 5 - 9 ppm or until deactivated by the H₂S Safety Technician or the Anadarko Company Representative. A verbal Low Level H₂S Audible will be announced over the PA System.
Condition I warning posters will be posted at all exits from the living quarters, accesses to Rig from heliport, and personnel basket unloading areas.
3. Characterized By:
Drilling operations under control. Routine operations in zones that may contain hydrogen sulfide. Poisonous gases may be present in concentrations at threshold levels and may or may not be detectable by odor (See "Toxicity of Various Gases", Section B-1 of the Appendix). This condition will be in effect continuously from the time the H₂S concentration reaches 5 ppm unless it is necessary to go to Condition II or III. Action to be taken under Condition I is contained under Section V "H₂S Emergency Procedures".

4. General Action:

- a. Be Alert for a condition change. There will be **NO SMOKING**
- b. Check safety equipment for proper functioning. Keep it available.
All Hot Work will cease.
- c. Follow the instructions of supervisor.

C. CONDITION II: Moderate Danger to Life
H₂S Present at 10 to 49 ppm

1. Warning Sign:

DANGER POISONOUS GAS
HYDROGEN SULFIDE
DO NOT APPROACH IF RED LIGHTS ARE FLASHING

Signs on all sides of the Rig (Yellow with black lettering visible at night)

Alarm: Work Areas, Living Quarters and Pinpoint Alarms Continuous sounding of the H₂S siren (constant tone) and red light flashing. All alarm signals will continue as long as the H₂S concentration is present at 10ppm or higher or until deactivated by the H₂S Safety Technician or the Anadarko Company Representative. A verbal H₂S Audible Mid Level Condition II will be announced over the PA System.

2. Characterized By: Critical well operations or well control problems. Poisonous gases are present above threshold levels (as defined under "Toxicity of Various Gases", Section B-1 of the Appendix). This condition shall be in effect when the H₂S concentration is present at 10 to 49 ppm.
3. General Action: At 20ppm the BSEE and U.S.C.G. will be notified
 - a. Go and stay in the upwind SAFE BRIEFING AREA with self-contained breathing apparatus and Type 1 life jacket if not specifically assigned to correct or control the situation.
 - b. Follow the instructions of the OIM, Toolpusher, or the Anadarko Company Representative.
 - c. The OIM, Toolpusher, and the Anadarko Company Representative shall initiate emergency action as provided in this plan.
 - d. All persons working in the hazard area will wear self-contained breathing apparatus or air line units. All personnel will restrict their movements as directed by the OIM, Toolpusher, and the Anadarko Company Representative.
 - e. All persons in the living quarters will pick up their Type 1 Life Jackets and self-contained breathing apparatus and proceed to the appropriate safe briefing area; if required.
 - f. If the well is ignited, the burning hydrogen sulfide will be

converted to sulfur dioxide, which is also poisonous. Therefore, DO NOT ASSUME THAT THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES. FOLLOW THE INSTRUCTIONS OF THE SUPERVISOR. (SEE "EMERGENCY PROCEDURES FOR SO₂")

**D. CONDITION III: Extreme Danger to Life
H₂S Present at Greater than 50 ppm**

1. Warning Sign:

DANGER POISONOUS GAS
HYDROGEN SULFIDE

DO NOT APPROACH IF RED LIGHTS ARE FLASHING

Signs all sides of the Rig (yellow with black lettering to be visible at night).

2. Alarm:

Work Areas, Living Quarters and Pinpoint Alarms Continuous sounding of the H₂S siren (solid tone) red lights flashing. A verbal High Level Condition III H₂S Audible will be announced over the PA System.

All alarm signals will continue as long as the H₂S concentration is present at greater than 50 ppm, or until deactivated by the H₂S Safety Technician or the Anadarko Company Representative.

3. Characterized By:

Loss of well control or the H₂S concentration is greater than 50 ppm.

4. General Action:

BSEE and U.S.C.G. will be notified

- a. All non-essential personnel or all personnel if the situation warrants, shall be evacuated. Radio and other available communications shall be used to alert all known air and water craft in the immediate vicinity of the Rig. The Anadarko Company Representative will advise the Anadarko Company Drilling Superintendent of the plans to evacuate the Rig. Notification of local civil authorities will be made by the Anadarko Company Drilling Superintendent.
- b. All people not specifically assigned to correct or control the situation shall stay in the appropriate upwind "Safe Briefing Area" until evacuated by a crew boat, workboat, helicopter, or escape capsule. A suggested list of essential personnel to be left aboard is listed in Section IX. The number of essential personnel may be increased at the request of the Anadarko Company Representative, or on order of the OIM.
- c. If the alarm sounds and it has not been preceded by Condition II, the actions of Condition III shall be taken. Circulation will be stopped and self-contained breathing apparatus and air line work units shall be donned by all working personnel. A T-Card system will be utilized to account for all personnel. Vessels will be notified. The Rig clerk and shore dispatchers will also be notified of the condition and will continuously monitor the radio.

- d. The OIM and the Anadarko Company Representative shall jointly determine other action that is necessary. Operations will continue to correct the situation with an absolute minimum of personnel in the affected area. Final decision (prior to) to ignite the well shall rest with the OIM and Anadarko Company Representatives after attempting to contact the Anadarko Company Drilling Superintendent.
- e. If the well is ignited, the burning of Hydrogen Sulfide will be converted to Sulfur Dioxide which is also poisonous. DO NOT ASSUME THAT THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES. Follow the instructions of Supervisors.

V. H₂S EMERGENCY PROCEDURES
(According to the Operating Condition Declared)

A. EMERGENCY PROCEDURES FOR CONDITION I

If at any time as much as 5 ppm of H₂S is detected, the following steps will be taken:

1. The person detecting the H₂S must IMMEDIATELY notify the driller. He must notify the OIM and Anadarko Company Representative, as applicable.
2. The H₂S Technician shall put on his self-contained breathing apparatus and take hand held detectors to the Rig floor and verify the presence and source of the H₂S.
3. When notified of Condition I, II, or III, the driller will shut-down the mud pumps and continue to rotate the drill pipe.
4. The following personnel will immediately put on their breathing air units.
 - a. All personnel on the Rig floor.
 - b. All personnel at the mud pits and shale shaker area.
 - c. All personnel in the area of the BOP's.
 - d. All personnel downwind of the source of the H₂S.
5. The OIM will alert all personnel in work areas that a Condition I exists. He shall be prepared to shut off the forced air circulation system and close all hatches downwind of, and below, the source of H₂S.
6. The Mud Engineer will run a Sulfide Determination on the flowline mud using a Garrett Gas Train or similar test.
7. A maximum effort must be made by supervising personnel to determine the source of the H₂S and to suppress the H₂S as quickly as possible. Drilling operations must not proceed until the source of the H₂S is determined and the well is circulated. Rig floor, mud pit and shale shaker personnel will keep breathing air equipment on while monitoring this circulation.
8. The OIM will make sure all non-essential personnel are out of the potential danger area (mud pit area, mud storage room, store room, etc.). All personnel who remain in the potential danger areas must utilize the "Buddy System".
9. The H₂S Safety Technician will order all personnel to check their safety equipment to see that it is working properly and is in the proper location.
10. The Anadarko Company Representative shall notify the Anadarko Company Drilling Superintendent of current conditions and action taken.
11. The H₂S Safety Technician will see that all monitoring devices are functioning properly and reading accurately and will increase gas monitoring activities with portable units.

12. The Anadarko Company Representative or OIM shall direct the Rig Clerk and the shore dispatcher to notify all boats in the area to go upwind to stay on power and to maintain a continuous radio and visual watch.
13. The Anadarko Company Representative or OIM shall direct the Rig Clerk and shore dispatcher to notify aircraft in route to the Rig of current conditions and the action to be taken.
14. DANGER POISONOUS GAS, HYDROGEN SULFIDE, DO NOT APPROACH IF RED LIGHTS ARE FLASHING warning signs must be posted on all sides of the drilling Rig.
15. The Anadarko Company Representative or OIM will alert the Rig Clerk to assure radio and phone watch.

B. EMERGENCY PROCEDURES FOR CONDITION II AND III

If the H₂S concentration reaches 10 ppm, and the well is NOT attempting to flow, the following steps will be taken in addition to those steps listed above for Condition I.

1. The person detecting the H₂S must IMMEDIATELY notify the driller. He must then notify the OIM and Anadarko Company Representative as applicable.
2. The driller will shut down the mud pumps and continue to rotate the drill pipe.
3. The following personnel will immediately put on their breathing units:
 - a. Anadarko Company Representative
 - b. OIM
 - c. H₂S Technician
 - d. Driller
 - e. Derrick Man
 - f. Three Floor Hands
 - g. Mud Pit Personnel (including Mud Engineer)
 - h. Mud Logger
4. Once breathing air equipment has been donned, the driller should:
 - a. Continue to rotate drill pipe
 - b. Pick up the drill string off bottom
 - c. Shut down Mud Pumps
 - d. Be ready to close the BOP's
 - e. Follow the "Well Control Procedure" in Section A-1 of the Appendix if well control problems develop.
5. The OIM will alert all personnel in work areas that a Condition II or III exists. He shall be prepared to shut off the forced air circulation system and to close all hatches downwind of, and below, the source of H₂S.
6. All personnel outside of the living quarters and NOT listed above, must get their Type 1 Life Jacket and assigned self-breathing apparatus, and report to the upwind "Safe Briefing Area" for further instructions. If both

your assigned self-contained breathing apparatus and the "Safe Briefing Area" are upwind of the wellbore, the self-contained breathing apparatus may be carried to the briefing area; however, if there is any doubt, don and activate the unit immediately. If it becomes necessary to go through the Rig floor or wellhead area to get to the "SAFE BRIEFING AREA", the breathing air equipment should be put on as soon as the equipment is reached. If you are located on the downwind end of the Rig or below the main deck when the Condition II or III alarm is sounded, hold your breath and proceed to the upwind "SAFE BRIEFING AREA", donning the nearest breathing air equipment available. Under a Condition III, those personnel inside the living quarters will don their self-contained breathing apparatus and Type 1 life jacket and proceed to the upwind "SAFE BRIEFING AREA". Under a Condition II, all personnel inside the living quarters will go to the muster area and then proceed to the appropriate "SAFE BRIEFING AREA", if required. **Once at the safe briefing area personnel should plug-in and utilize the Cascade System. An effort should be made to conserve air in the self contained breathing apparatus.**

Always put on breathing air equipment before assisting someone affected by H₂S gas, and utilize the "buddy system". If the affected person is stricken in a high concentration area, put on a safety harness with retrieval line and obtain standby assistance before entering the area. Always use the "buddy system" when entering possibly contaminated areas.

The Anadarko Company Representative or OIM shall direct the Rig Clerk and the shore dispatcher to notify all boats in the area to go upwind to stay on power and to maintain a continuous radio and visual watch.

The Anadarko Company Representative or OIM shall direct the Rig Clerk and shore dispatcher to notify aircraft in route to the Rig of current conditions and the action to be taken.

Signs displayed: DANGER POISONOUS GAS, HYDROGEN SULFIDE, DO NOT APPROACH IF RED LIGHTS ARE FLASHING".

7. Tell the Rig Clerk and Shore Dispatcher to establish a 24-hour radio and phone watch. Shore dispatcher shall alert helicopters and vessels to standby for possible evacuation.
8. Evacuate non-essential personnel when H₂S reaches a concentration exceeding 50 ppm in the air (Condition III). The life boat capsules will be utilized to evacuate personnel. The secondary means of evacuation will be the inflatable life rafts.

9. The Anadarko Company Representative and the OIM will assess the situation and assign duties to each person needed to bring the situation under control. When the severity of the situation has been determined, all persons will be advised. The Anadarko Company Representative and the OIM will:
 - a. Direct corrective action.
 - b. Notify the Anadarko Company Drilling Superintendent and the Rig Contractor's Superintendent.
10. The Anadarko Company Drilling Superintendent will be responsible for notifying the following regulatory agencies:
 - a. BSEE
 - b. U.S. Coast Guard
 - c. Any other Required Agency
11. If an H₂S concentration exceeding 50 ppm in the air is recorded at the outer perimeter of the Rig, notify all appropriate regulatory agencies and alert by radio communication all known air and water craft in the immediate vicinity of the Rig location.

VI. SPECIAL OPERATIONS

A. CORING

1. During drilling operations it may be decided to core. This operation takes on critical complexities when attempted in a sour gas well. The following practices should be followed during coring operations.
 - a. After a core has been cut, circulate bottoms up and monitor mud for H₂S prior to pulling out of the hole with the core.
 - b. **Put on breathing air equipment ten stands before core barrel reaches the surface.** If well conditions dictate, or the H₂S concentration reaches 20 ppm, breathing air equipment should be put on sooner. Breathing air equipment should be worn by all personnel in the area while the core barrel is pulled, broken out, and opened. Gastec units and individual ampoules should be used to monitor for H₂S around the core barrel. When these detectors indicate a safe atmosphere, the breathing air equipment may be removed.
2. The following practices must be followed for every core barrel pulled:
 - a. Due to the difficulty in communicating with breathing equipment on, it is required that a chalkboard and chalk, or note pads, be available during core handling operations.
 - b. The importance of leaving the breathing air equipment on must be stressed to all personnel connected with the coring operation. The most critical moment is when the core barrel is opened.
 - c. All personnel on board not wearing breathing air equipment should stay a safe distance upwind from the core barrel.
 - d. If the core contains H₂S, the cores to be transported must be sealed and marked for the presence of H₂S.
 - e. The cores must not be transported in a closed vehicle or closed area on the boat.

B. Other Operations (logging, stripping)

1. Logging Operations: You must treat and condition well-control fluid in use for logging operations to minimize the effects of H₂S on the logging equipment.
2. Stripping Operations: Personnel must monitor displaced well control fluid returns and wear protective breathing equipment in the working area when the atmospheric concentration of H₂S reaches 20 ppm or if the well is under pressure.
3. Gas-cut well control fluid or well kick from H₂S bearing zone: If you decide to circulate out a kick, personnel in the working area during bottoms-up and extended-kill operations must wear protective breathing equipment.
4. Drill strings must be designed consistent with the anticipated depth, conditions of the hole, and reservoir environment to be encountered. You must minimize exposure of the drill string to high stresses as much as practical

and consistent with well conditions. Proper handling techniques must be taken to minimize notching and stress concentrations. Precautions must be taken to minimize stresses caused by doglegs, improper stiffness ratios, improper torque, whip, abrasive wear on tool joints, and joint imbalance.

C. WELL TESTING

1. Well testing must be performed with the minimum number of personnel in the immediate vicinity of the Rig floor and all appropriate equipment required to safely and adequately perform the test.
2. Prior to initiation of the test, special safety meetings must be conducted for all personnel who will participate, with particular emphasis on use of personnel safety equipment, first-aid procedures, and the "H2S Contingency Plan".
3. During the test, the use of H2S detection equipment will be intensified. All produced gases must be vented and burned through a flare system equipped with continuous pilot and an automatic igniter. Back-up ignition for each flare must be provided. Produced fluids which are stored in the tanks on the Rig must be vented into the flare system. SO₂ monitoring equipment must be activated. If SO₂ is detected in excess of 2ppm, designated personnel will don SCBA's and take protective measures to correct the problem utilizing the buddy system. (SEE "EMERGENCY PROCEDURES SO₂")
4. Downhole test tools and wellhead equipment suitable for H2S service will be used.
5. Only Tubulars suitable for H2S service will be used. Do not use drill pipe for well testing without approval of the District Supervisor of the BSEE. Water cushions must be thoroughly inhibited in order to prevent H2S attack on metals. You must flush the test string fluid treated for this purpose after completion of the test.
6. Use surface test units and related equipment that is designed for H2S service.
7. **"NO SMOKING" rules will be rigorously enforced.**

VII. WELL CONTROL

The following well control practices should be initiated:

- A. If high trip gas or high drill gas concentrations are encountered, the degasser should be used and the gas separated and burned through the flare burner.

If gas is breaking out at the rotary, consider closing the annular BOP and routing the flow through the mud-gas separator. Gas will be burned through the flare burner.

- B. Assume any influx of formation fluid into the wellbore contains H₂S. If the decision is made to circulate out the influx, all personnel involved will wear breathing air equipment until it is known that H₂S is not present. The following steps should be taken when the influx occurs:
1. Shut in the well using normal techniques. Record drill pipe pressure, casing pressure, and volume of influx.
 2. Notify the OIM and Anadarko Company Representative.
 3. If directed to circulate out the influx, proceed as outlined in the "Well Control Procedure" in Section A-1 of the Appendix.

If the mud has been contaminated with H₂S, it will be necessary to treat it with zinc basic carbonate (or equivalent) to treat out the H₂S. A "Mud Treating" procedure is given in Section A-3 of the Appendix. If H₂S is known to be present and an influx occurs, the amount and type of open hole, and the weather conditions will enter into the management decision of whether it circulate out the influx or to "pump away" the influx back into the formation.

VIII. LOST CIRCULATION

If the lost circulation occurs, proceed as outlined in the "Lost Circulation Procedure" in Section A-2 of the Appendix.

IX. PARTIAL EVACUATION PROCEDURE

In the event that it becomes necessary to evacuate the Rig due to well control problems or fire, the Drilling Rig Fire and Boat Station and Abandonment Platform Procedure posted in the galley, crew quarter hallways and OIM's office will be used.

Key personnel to remain on board during a partial evacuation are:

Drill Crew

- 1- Toolpusher
- 2-SSE (Sub Sea Engineers)
- 1 - Driller
- 4 - Floormen
- 1 - Derrickman

Vessel Support Team

- 2- BCO's (Ballast Control Operator)
- 2-DPO's (Dynamic Position Operator)
- 2- Crane Operators
- 2- Mechanics
- 2-Electricians
- 1-STC / Medic

Others (as required)

- 1 - H₂S Safety Technician

Supervisor Personnel

- 3 - Anadarko Company Drilling Representative
- 1 - OIM
- 1-Rig Maintenance Supervisor
- 1-Barge Supervisor
- 1-Chief Mechanic
- 1-Chief Electrician

x. IGNITING THE WELL

A. RESPONSIBILITY FOR DECISION

In the event of severe well control problems, the final decision to ignite the well is the responsibility of the OIM. This decision should be made only as a LAST RESORT in situations where it is clear that 1) human life is endangered, or 2) there is no hope of controlling the blowout under the prevailing conditions at the well site. The OIM should make such a decision ONLY after consulting with the ranking Anadarko Company Representative on board, if time and circumstances permit. He must not delay his decision, however, if human life or safety is threatened.

IN ALL CASES, AN ATTEMPT SHOULD BE MADE TO NOTIFY THE Anadarko COMPANY DRILLING SUPERINTENDENT AND THE RIG CONTRACTOR'S SUPERINTENDENT AS SOON AS POSSIBLE AND PRIOR TO IGNITING THE WELL IF POSSIBLE.

If the well is ignited, the burning H₂S will be converted to SO₂, which is also highly toxic and heavier than air. Hence, do not assume the area is safe after the well is ignited.

B. METHODS OF IGNITION FOR LOSS OF ALL WELL CONTROL

1. The primary method of igniting the vent line will be with a Flare Stack Igniter and the secondary means of ignition is a flare gun, which has a range of approximately 500'. Always ignite the well from upwind and do not approach the well any closer than is necessary. BEFORE FIRING the flare gun, or igniting flammable material, check the atmosphere at your location for combustible gases with an explosion meter.
2. If the above method of ignition fails, or well conditions are such that a safer or better method is apparent, then an alternate method should be used.

XI. RESPONSIBILITIES

A. ALL PERSONNEL

1. It is the responsibility of all personnel on the Rig, as well as any other personnel assisting in the drilling of the well, to familiarize themselves with the procedures outlined in the "H₂S Contingency Plan".
2. Each individual is responsible for seeing that his assigned safety equipment is properly stored, easily accessible and routinely maintained.
3. Each person must familiarize himself with the location of all safety equipment aboard the Rig and be able to use all safety equipment at a moment's notice. The location and quantity of all safety equipment is given in Section C-1 of the Appendix.
4. All personnel must read and understand the H₂S Contingency Plan.
5. Report any indications of H₂S to those in the area and to the Company Representative.

B. DRILLING REPRESENTATIVE

1. The Anadarko Company Representative is responsible for thoroughly understanding and enforcing all aspects of the "H₂S Contingency Plan".
2. The Anadarko Company Representative is responsible for seeing that all safety and emergency procedures outlined in the "H₂S Contingency Plan" are observed by all personnel participating in the drilling of the H₂S well.
3. The Anadarko Company Representative will advise the Anadarko Company Drilling Superintendent whenever the procedures, as specified herein, cannot be complied with.
4. The Anadarko Company Representative is responsible for setting up the location for drilling a sour gas well as described under Section II "Safety Equipment".
5. The Anadarko Company Representative in conjunction with the OIM are responsible for seeing that all hardware and replacement parts in the choke manifold lines, flare lines, and all other piping which may be required to carry H₂S contaminated fluids under high pressure, are suitable for H₂S service. (NACE Standard MR. 01-75-03)
6. The Anadarko Company Representative in conjunction with the OIM is responsible for scheduling personnel training.
7. If the presence of H₂S is reported and confirmed, the Anadarko Company Representative is responsible for immediately advising the OIM and the Anadarko Company Drilling Superintendent.
8. The Anadarko Company Representative shall restrict the number of personnel on the Rig to a minimum during expected hazardous operations.

C. OIM

1. The OIM is responsible for thoroughly understanding the contents of the "H₂S Contingency Plan". In the absence or incapacitation of all Anadarko Company representatives, the OIM will assume responsibilities designated herein to the Anadarko Company Representative.
2. It is the responsibility of the OIM along with the Anadarko Company Representative to see that all safety and emergency procedures outlined in the "H₂S Contingency Plan" are observed by all personnel aboard the Rig.
3. The OIM in conjunction with the Drilling Representative are responsible for seeing that all hardware and replacement parts in the choke manifold lines, flare lines, and all other piping which may be required to carry H₂S contaminated fluids under high pressure, are suitable for H₂S service. (NACE Standard MR. 01-75-03)
4. The OIM shares the responsibility of the Anadarko Company Representative in scheduling training for personnel aboard the Rig.
5. The OIM will be responsible for shutting off the forced air circulating system and closing all hatches in the event that H₂S is detected in the atmosphere at any time.
6. The OIM in conjunction with the Anadarko Company Representative will be responsible for inspecting the Rig to make sure that all passageways remain unobstructed.
7. The OIM is responsible for alerting all personnel during a Condition I, II, or III alert and for displaying warning signs as outlined under Section IV "Operating Conditions - Classification".
8. The OIM is responsible for notifying all personnel in the area of the Rig (including any work boats and/or helicopters) of a change in conditions.
9. The OIM in consultation with the Anadarko Company Representative is responsible for the final decision to ignite the well.

D. H₂S SAFETY TECHNICIAN

1. The H₂S Safety Technician is responsible for performing a weekly inventory to assure that all safety equipment is being properly stored and maintained.
2. The Drilling Contractor Medic is responsible for immediately giving the Rig orientation to all personnel arriving at the Rig. The H₂S Safety Technician is responsible for performing full H₂S training or an H₂S briefing (for visitors staying less than 24 hrs), as per the 30CFR 250.490, BSEE rules and regulations.
3. The H₂S Safety Technician is responsible for the H₂S training, which includes the use, maintenance, and storage of the safety equipment.
4. The H₂S Safety Technician is responsible for issuing H₂S safety equipment to arriving personnel on the Rig and for collection of same from departing personnel.
5. The H₂S Safety Technician is responsible for the maintenance and repairs of

- all personnel's H₂S safety equipment.
6. The H₂S Safety Technician is responsible for the required inspection and sanitizing of the H₂S safety equipment.
 7. The H₂S Safety Technician is responsible for the maintenance of all H₂S Safety Training Class Attendance Records. A copy of all H₂S training will be kept on board the Rig.
 8. The H₂S Safety Technician will observe and assist during weekly H₂S drills. (Drills will be held every seven days) The H₂S Technician will give a copy of the drill report to the driller, who will record the drill on the IADC report.
 9. The H₂S Safety Technician will test the designated H₂S monitors daily. A copy of the results will be given daily to the Anadarko Company Representative.

E. DRILLER

1. The Driller must be completely familiar with the steps he must take during a Condition I, II, or III Emergency as outlined under Section V "H₂S Emergency Procedure".
2. The Driller must be completely familiar with his special duties while coring and testing an H₂S well as outlined under Section VI "Special Operations".
3. The Driller must be completely familiar with his duties during well control and lost circulation problems as outlined under Section VII "Well Control" and Section VIII "Lost Circulation".
4. In the absence or incapacitation of all Anadarko Company Representatives, OIM, and Toolpusher, the Senior Driller will assume responsibilities as designated herein.

F. MUDLOGGER

1. The Mudlogger is responsible for turning off the switch inside the mudlogging unit that controls the forced air duct leading to the unit, if the H₂S alarm sounds.
2. The Mudlogger is responsible for a multi-gas detector which will be kept in the mudlogging unit.
3. The Mudlogger is responsible for becoming knowledgeable in operation and use of his self-contained breathing apparatus.

G. MUD ENGINEER

1. The Mud Engineer must be familiar with the "Barite Plug Setting Procedure" in Section A-4 of the Appendix.
2. The Mud Engineer must have a Garret Gas Train Kit for measuring the sulfides in the mud.
3. The Mud Engineer is responsible for becoming knowledgeable in the operation and use of his self-contained breathing apparatus.
4. The Mud Engineer must be familiar with the "Mud Treating" procedure for

H₂S cut mud in Section A-3 of the Appendix.

5. The Mud Engineer is responsible for assuring that the Rig has a sufficient supply of 100% zinc basic carbonate or equivalent.

H. CEMENTER

1. The Cements must be familiar with the "Barite Plug Setting Procedure" listed in Section A-5 of the Appendix.
2. The Cements is responsible for becoming knowledgeable in the operation and use of his self-contained breathing apparatus.

XII. RESPONSIBILITIES AND DUTIES SO₂/FLARING

- A. When flaring, hourly readings will be monitored with a fixed or portable instrument implementing the buddy system. SO₂ calibration will occur at least once every 3 months
- B. Detection of 2ppm of SO₂: Personnel protective measures will be taken by personnel in work areas affected by 2ppm of SO₂. Self-contained breathing apparatus will be utilized to take hourly readings using the buddy system. All unnecessary personnel will remain out of the affected area upwind. Quarters or briefing areas will be utilized as needed pertaining to emergency conditions as described in this plan for H₂S and the concentration of SO₂.
- C. Detection of 5ppm of SO₂: Personnel protective measures will be taken by personnel in work areas affected by 5ppm of SO₂. Self-contained breathing apparatus will be utilized to take hourly readings using the buddy system. All unnecessary personnel will be evacuated from the affected area and if necessary from the facility using only designated personnel to take corrective action. The designated personnel will be the same as listed for an H₂S emergency response. Briefing areas will be utilized as necessary. H₂S readings will be monitored and logged along with SO₂ readings. (See Section B-6)

XIII. PROCEDURE FOR INFORMING PERSONNEL OF H₂S CONTINGENCY PLAN

- A. There will be several copies of the complete H₂S Contingency Plan available in the Anadarko Company Representative's office.
- B. ALL personnel arriving at the Rig will report immediately for Rig orientation. After Rig orientation personnel will immediately report to the H₂S Safety Technician for familiarization of the H₂S Contingency Plan and H₂S training. Each person will be required to sign a training log that they have been trained in the procedures as outlined in the H₂S contingency plan. Training records will be kept on the Rig. The H₂S Safety Technician will train the crews and familiarize them with all aspects of the H₂S contingency plan. Written records will be maintained.
- C. A copy of the H₂S Contingency Plan will be given to the Captain of each of the support vessels. They will be required to sign a log indicating that they have read and understand the plan.

XIV. SEARCH & RESCUE TEAMS

(Roustabouts on & off tower will be designated as teams.)

- A. Rescue team members must realize that the primary goal of the team should be to inspect all areas of the Rig for personnel who have been overcome by H₂S or SO₂. However, from a practical stand point, the potential for someone to be overcome is greatest during a Condition III release as indicated by the Flashing RED lights and siren, it is essential that the Rescue Teams report to the staging area & report in with their assigned SCBA units and then immediately begin a search of the below deck areas.
- B. During drilling activities, the three most critical areas can be defined as the shale shaker area, mud pit area and drill floor area. The trip tank area is also critical when tripping pipe. Accordingly, the H₂S Emergency Station Bill is designed to ensure that such areas are quickly evaluated after and/or during any significant H₂S release. For example, the H₂S Safety Technician procedures during such times ensure that the shaker area and trip tank area will be checked, while the Anadarko Company Representative and OIM procedures ensure the drill floor checked. In addition, the Rescue Team procedures ensure that all below deck water-tight doors will be secured to prevent migration of gas.
- C. Rescue Team members must realize that in the event an unconscious victim is found, it may or may not be necessary to move the victim before administering the necessary first-aid. The determining factor will be the presence of H₂S contamination or some other threat, which poses an immediate danger to victim as well as the rescuers. Since procedures call for the mud pumps to be shut down if H₂S is detected, it is unlikely that large volumes of H₂S will continue to be released.
- D. This coupled with the ventilation systems present on the Rig, enhance the possibility that any gas released initially will be quickly purged from an area, such as the pit room. Persons found unconscious may have tripped or fallen when responding to the H₂S alarms, and as a result may have suffered neck or spinal injuries. In such a case, moving the victim could prove fatal. Therefore, it is essential that the Rescue Team properly determine not only the victim condition, but also the condition of the surrounding area.

SEARCH & RESCUE TEAM PROCEDURES AND DRILLS

A. CONDITION I AND II

1. ON -DUTY TEAMS: IN THE EVENT OF A CONDITION I OR II

- a. Proceed to staging area and report in, then don 30 minute SCBA. Do not open cylinder valve or put on facepiece.
- b. Check portable H₂S detectors.
- c. Proceed to designated Safe Briefing Area.

B. CONDITION III

1. ON-DUTY TEAMS: IN EVENT OF A CONDITION III RELEASE

- a. Proceed to staging area and report in, then don assigned RESCUE TEAM SCBA and wait for other team members for 1 minute.
- b. Check portable H₂S Detectors.
- c. In the event a team member(s) is missing, proceed as a group of 3 or 2. Do not proceed alone.
- d. Proceed in teams down to designated start point.
- e. Secure watertight doors and hatches along way to prevent migration of gas.

Team 1- Scan Pipe Deck and Main Deck work areas on starboard side of Rig. Wait in designated area for Team 2. If Team 2 does not arrive within 1 minute, search Team 2 route until you find Team 2. Search living quarters on way to designated safe briefing area.

Team 2- Scan Pipe Deck and Main Deck work area on port side of Rig. Wait in designated area for Team 1. If Team 1 does not arrive within 1 minute, search Team 1 route until you find Team 1.

Search living quarters with Team 1 on way to designated safe briefing area.

If only one Team-Search all compartments on Main Deck.

Continue to secure all watertight doors and hatches to prevent gas migration.

SEARCH & RESCUE TEAM PROCEDURES continued

- f. In the event you encounter a person(s) in distress:

One Team Member checks to see if victim is breathing while other Team Member checks for H2S in area.

- 1) If victim is breathing and no contamination is present, alert H2S Safety Technician and/or Contractor Medic. Continue to monitor area with H2S Detectors.
- 2) If victim is breathing and/or contamination is present remove victim to safe area ASAP.
Verify safe from H2S contamination with Portable Detector, before removing mask.
- 3) Check victim again for breathing and pulse (heartbeat).
- 4) Administer Mouth-to-Mouth resuscitation if victim is not breathing or CPR, if victim has no heart beat.
- 5) Alert Contractor Medic and/or H2S Safety Technician ASAP. Do not leave anyone in distress unattended.
- 6) Obtain O2 Resuscitator and stretcher ASAP. Typically, this equipment should be brought to scene by the H2S Safety Technician and Contractor Medic.
- 7) Replace mouth-to-mouth activities with the mechanical resuscitator ASAP.
- 8) Transfer patient(s) to Safe Briefing Area or Hospital Room ASAP.

NOTE: When transferring a patient, every effort must be made to utilize a route that has been verified to be gas free. If a breathing patient must be transferred through an area that could potentially be contaminated, it will be necessary to utilize an SCBA to protect the patient.

- g. Rescue Teams should meet in the Staging Area or designated Safe Briefing Area after completing their respective search activities.
- 1) If only one team has conducted the search, then proceed from the Bulk Mud Room to the Designated Safe Briefing Area.
 - 2) Report to Supervisors and be prepared to conduct additional search, rescue and/or hazard assessment activities.
 - 3) Check SCBA cylinder to ensure it contains a minimum of 1500 p.s.i. recharge cylinder if necessary.

2. OFF-DUTY RESCUE TEAM: IN THE EVENT OF A CONDITION I, II OR III

- a. Proceed to designated Safe Briefing Area.
- b. Be prepared to assist as needed.

APPENDIX SECTION A

PROCEDURES

SECTION A-1

WELL CONTROL PROCEDURE

All efforts should be made to prevent a well kick, which may result from gas cut mud, abnormal pressure, and loss in circulation, or swabbing. Should any of the following conditions occur, the well should be checked for flow:

1. Increase in flow across the shale shaker.
2. Gain in pit volume.
3. Hole does not take correct fill on trips.
4. Significant drilling break.
5. Decrease in pump pressure.
6. Significant increase in connection gas.

If well flow is confirmed, the following actions will be taken:

Operation procedure for blowout preventer system while drilling

1. Pick up to position drill pipe tool joint for closure of BOP's.
2. Shut mud pump off, check for flow
3. Close annular preventer observe drill pipe and casing pressure, keep drill pipe moving at all times
4. Notify OIM and Anadarko Company Representative

Operation procedure for blowout preventer system while tripping

1. Set Stand in slips.
2. Install spare safety valve with valve in open position.
3. Close safety valve.
4. Close annular preventer.

5. Engage Top Drive and keep drill pipe moving at all times
6. Notify OIM and Anadarko Company Representative.

The handling of the H₂S kick will normally involve one of the two following techniques:

- Pumping the Kick Away
- Circulating the Kick Out

The technique selected must be based on the conditions existing at the time of the occurrence. The selected technique will have as its objective the protection of human life, protection of the environment, and protection of property, respectively.

When high concentrations of H₂S are suspected, and it is operationally feasible, H₂S kicks will be pumped away rather than circulated out. This plan of action has the advantage of minimizing the surface risk to personnel, environment, and service equipment.

In some cases, it will be necessary to set a barite or cement plug over the H₂S bearing formation to accomplish proper well control.

When the decision is made to circulate out the H₂S kick, operations should not be initiated until briefings have been held with personnel involved and equipment is made ready and alert warning signs are displayed.

All personnel on the Rig floor and all personnel working in other susceptible areas should put on their breathing air equipment when the kick is being circulated out.

The Anadarko Company Representative should make sure all non-essential personnel are evacuated.

SECTION A-2

LOST CIRCULATION PROCEDURE

If lost circulation is experienced during any phase of the drilling operation, every effort will be made to fill the hole. The driller should:

1. Pick up the kelly above the rotary table and shut down the mud pumps. Space out to insure that a tool joint is not in the BOP's.
2. Notify the Anadarko Company Representative and OIM as soon as practical.
3. Fill trip tank with water (seawater, drill water, or diesel may be used). Consideration should be given to keeping one side of the trip tank filled with water during drilling operations.
4. Begin filling hole from the trip tank. (NOTE: It is very important to know the volume of water used to fill the hole.)
 - a. Switch the mud pumps to the kill line and line up to pump water if necessary. Reset stroke counters on remote control choke panel.
 - b. If hole will not fill from the trip tank, begin pumping water into the annulus with the mud pumps.
5. When hole fills, determine and record the volume of water required to fill the hole.
 - a. Check well for flow. If well is static and hole stands full, monitor for possible flow. Keep trip tank on the hole.
 - b. If well is flowing, shut well in per "Well Control Procedure".
6. Procedure to regain circulation will be developed based on hole conditions. **DO NOT PULL INTO CASING UNTIL APPROVED BY THE Anadarko COMPANY REPRESENTATIVE.** One or more of the following methods will be used:
 - a. Introducing loss circulation materials into the mud system and minimizing required mud weight.
 - b. Spotting loss circulation pills opposite the suspected thief zone.
 - c. Bull heading cement into the thief zone.
 - d. Pulling up into the casing to allow the hole to heal.
 - e. If the loss circulation problem is severe, consideration will be given to setting an additional casing string through the thief zone.

SECTION A-3

MUD TREATING

1. Zinc carbonate or an equivalent scavenger, will be used to treat H₂S in the mud system. It should not be added to the system until soluble sulfides are detected in the mud by the Mud Engineer and approval is given by the Anadarko Company Representative to add the H₂S scavenger.
2. After H₂S is detected, the initial treatment of zinc carbonate or equivalent should be sufficient to treat the soluble sulfides to approximately "0". Treatment in excess is not recommended.
3. The mud system must be maintained with a Ph greater than 10.0. The pH of the mud system will be maintained by adding lime or caustic soda or equivalent and the high pH should be maintained. A rapid decrease in pH is a possible indication of the presence of H₂S in the mud system.
4. The mud system could very well contain H₂S and/or sulfides in the mud if the agitation is not adequate to remove all of it.
5. The Mud Engineer will have readily available, aboard the Rig, a Garrett Gas Train Kit or equivalent to determine the presence and approximate amount of soluble sulfides in the mud filtrate.
6. The Mud Engineer will test for sulfides at least every 12 hours using Garret Gas Train method or equivalent. Detailed instruction for performing these tests will be maintained on the Rig (API RP 13B).
7. The results of these checks or any other indication of H₂S in the mud system will be included as a routine part of the Mud Engineer's daily reports.
8. Pilot test mud samples are required to know in advance the effect of 1/2 and 1lb/bbl concentrations of zinc carbonate or equivalent on the properties of the mud system.

SECTION A-4

BARITE PLUG INFORMATION

PRESSURE CONTROL

A very critical situation can arise when a well begins kicking and losing circulation at the same time. Increasing the mud weight to control the high pressure zone will only complicate the problem of lost circulation. When the high pressure zone lies below the thief zone, barite plugging may be used to control the well.

An extremely heavy, high water loss slurry is required for this technique. Barite settling and deposition will form a solid plug in the open hole and seal off the high pressure zone. The high filter loss results in rapid dehydration, bridging the hole and sealing off the high pressured zone. Once a barite plug is in place, normal steps for regaining circulation may be taken with relative safety.

Barite plugs weighing from 18 to 24 ppg may be prepared using barite, fresh water, phosphate (SAPP) and caustic soda. NO viscosifiers are used, and care must be taken to prevent contamination of the slurry with mud because settling of the barite, once it is spotted, is a necessity. The plug should be set as close to bottom as possible and pumped rapidly. The drill pipe then should be withdrawn to avoid sticking. Coarse grind barites are not recommended because the settling rate is reduced drastically.

A cementing unit should be used to mix the slurry. Barite is mixed with fresh water containing 0.8 ppb phosphate, and 0.25 ppb caustic. The lines from the cementing unit can be connected directly to the drill pipe through a plug valve. To minimize the possibility of stuck pipe, the derrickman should be in the derrick and the elevators ready to come out of the hole immediately after pumping is completed. A barite slurry may be mixed in the sloughing pit where continuous and violent agitation is possible.

PROCEDURES FOR SETTLING PLUG MIXING

Cementing Equipment

1. Clean and flush all mixing lines to and from cement mixing equipment. Arrange for weight material to be mixed rather than cement. This may require the use of sacked weight material. If sacked weight material is to be used, be sure that weight material sufficient for the plug can be placed near the mixing hopper. Estimate manpower and barite moving requirements (forklift and/or crane).

2. Measure mixing water for plug volume (take into account line volumes) into tank. If possible, mix caustic soda and lignosulfonate into mixing water. This may be done by using mud system slugging pit and pumping mixing water to cement mixing equipment. Mix 1 1/2 lb/bbl of caustic soda and 8 lb/bbl of chrome lignosulfonate in mix water.
3. Mix plug and pump "on the fly" using weight material and mixing water. Avoid mixing slurry below 16 lb/gal for barite weight material and below 20 lb/gal for hematite material as too rapid settling could occur and plugging of equipment or lines can occur.
4. Avoid "chasing" plug with water. Use mud to prevent premature settling of plug.

Mud Tank Slugging Pit

1. Empty and clean slugging pit. If unable to dump pit, fill with water and agitate. Pump out dirty water. Repeat, if necessary, to get pit clean.
2. Put just enough mixing water in pit to get and maintain mixing pump suction. Add the total calculated amount of caustic soda and chrome lignosulfonate to the mix water. Note quantity required and calculate remaining amount of water to be added to bring to total volume mix water.
3. Begin mixing weight material. Slurry should begin to look viscous when its density nears 16 lb/gal for barite and 20 lb/gal for hematite.
4. When slurry gets to approximately 18 lb/gal for barite and 21 lb/gal for hematite, begin adding remainder of mix water. Add mix water in steps with additional weight material to avoid both too light a slurry that will settle or too heavy a slurry that will lose pump suction. After adding the calculated volume of mix water, bring slurry to final desired density. Allow to mix until weight material is mixed thoroughly.
5. Pump plug to mud pump, avoiding water ahead or behind plug. Avoid "chasing" plug with water. Use mud to prevent premature settling of plug.

Barite Plug Formulation Settling vs Density

| | | | | |
|---|------|------|------|------|
| Barite plug density, lb/gal | 16 | 17 | 18 | 19 |
| Composition per barrel of mix water- Water, bbl | 1.00 | 1.00 | 1.00 | 1.00 |
| Chrome lignosulfonate, lb | 8.00 | 8.00 | 8.00 | 8.00 |
| Caustic soda, lb | 1.50 | 1.50 | 1.50 | 1.50 |
| Barite, lb | 592 | 707 | 835 | 978 |
| Final Plug Volume, bbl | 1.40 | 1.48 | 1.57 | 1.67 |
| Composition per barrel of final plug Water, bbl | 0.71 | 0.68 | 0.64 | 0.60 |
| Chrome lignosulfonate, lb | 5.70 | 5.40 | 5.10 | 4.80 |
| Caustic soda, lb | 1.07 | 1.01 | 0.96 | 0.90 |
| Barite, lb | 422 | 477 | 533 | 588 |
| | | | | |
| Settling test results Slurry temperature, °F | 88° | 78° | 89° | 83° |
| Settled volume vs time Volume @ 3 min, cu cm | 25 | 25 | 25 | 50 |
| Volume @ 6 min, cu cm | 50 | 50 | 50 | 55 |
| Volume @ 12 min, cu cm | 75 | 80 | 80 | 85 |
| Volume @ 30 min, cu cm | 115 | 115 | 135 | 130 |
| Volume @ 60 min, cu cm | 130 | 130 | 160 | 150 |
| Volume @ 960 min (16 hrs), cu cm | 160 | 170 | 170 | 210 |
| | | | | |
| Settling compaction index | 1.59 | 1.50 | 1.34 | 1.50 |

Note: Data on 16 lb/gal and 18 lb/gal from SR 1139

Mixing and testing Procedure:

1. Mix water, chrome lignosulfonate, and caustic soda. Shear until materials into solution.
2. Add barite and shear until slurry well mixed (10 minutes).
3. Pour plug into 500 cu cm graduated cylinder.
4. Measure settled volume of plug at 3 min, 6 min, 12 min, 30 min, 60 min and 960 min.

Hematite Plug Formulation Settling vs Density

| | | | | |
|---|------|-------|-------|-------|
| Barite plug density, lb/ gal | 20 | 21 | 22 | 23 |
| Composition per barrel of mix water- Water, bbl | 1.00 | 1.00 | 1.00 | 1.00 |
| Chrome lignosulfonate, lb | 8.00 | 8.00 | 8.00 | 8.00 |
| Caustic soda, lb | 1.50 | 1.50 | 1.50 | 1.50 |
| Barite, lb | 941 | 1,071 | 1,214 | 1,373 |
| Final Plug Volume, bbl | 1.54 | 1.61 | 1.69 | 1.78 |
| Composition per barrel of final plug Water, bbl | 0.65 | 0.62 | 0.59 | 0.56 |
| Chrome lignosulfonate, lb | 5.20 | 4.96 | 4.72 | 4.48 |
| Caustic soda, lb | 0.98 | 0.93 | 0.89 | 0.84 |
| Barite, lb | 612 | 665 | 717 | 770 |
| | | | | |
| Settling test results Slurry temperature, °F | 81° | 83° | 83° | 83° |
| Settled volume vs time Volume @ 3 min, cu cm | 10 | 10 | 15 | 15 |
| Volume @ 6 min, cu cm | 50 | 50 | 50 | 55 |
| Volume @ 12 min, cu cm | 135 | 140 | 105 | 95 |
| Volume @ 30 min, cu cm | 150 | 180 | 160 | 150 |
| Volume @ 60 min, cu cm | 175 | 185 | 200 | 225 |
| Volume @ 960 min (16 hrs), cu cm | 185 | 205 | 235 | 250 |
| | | | | |
| Settling compaction index | 1.51 | 1.54 | 1.64 | 1.63 |

Mixing and testing Procedure:

1. Mix water, chrome lignosulfonate, and caustic soda. Shear until materials into solution.
2. Add hematite and shear until slurry well mixed (10 minutes).
3. Pour plug into 500 cu cm graduated cylinder.
4. Measure settled volume of plug at 3 min, 6 min, 12 min, 30 min, 60 min and 960 min.

SECTION A-5

HELICOPTER SAFETY

HYDROGEN SULFIDE GAS HELIDECK/HELIPORT OPERATIONAL HAZARD WARNINGS/PROCEDURE(S)

Hydrogen Sulfide (H₂S) Gas: Hydrogen Sulfide gas in higher concentrations (300-500ppm) can cause loss of consciousness within a few seconds and presents a hazard to pilots on/near offshore helidecks. When operating in offshore areas that have been identified to have concentrations of Hydrogen Sulfide gas, the following practice is recommended.

1. Pilots:
 - (a) Ensure approved protective air packs are available when Helicopter is shutdown and crew is on the Rig. If H₂S is detected there will be no authorized flights to or from the Rig.
 - (b) If shutdown on a helideck, request the supervisor in charge provide a briefing on location of protective equipment and safety procedures.
 - (c) If while flying near a helideck and the visual red beacon alarm is observed or an unusually strong odor of "rotten eggs" is detected, fly upwind, and notify the suspected source field of the hazard.
2. Supervisors:
 - (a) If presence of Hydrogen Sulfide is detected, a red rotating beacon or red high intensity strobe light adjacent to the primary helideck stairwell or wind indicator on the structure should be turned on to provide visual warning of hazard. If the beacon is to be located near the stairwell, the Louisiana "Offshore Heliport Design Guide" should be reviewed to ensure proper clearance on the helideck.
 - (b) Notify nearby helicopter operations and bases of the hazard and advise when hazard is cleared.
 - (c) Provide a safety briefing to include location of protective equipment to all arriving personnel.
 - (d) Wind socks or indicator should be clearly visible to provide upwind indication for the pilot.

APPENDIX SECTION B

GENERAL INFORMATION

**SECTION B-1
TOXICITY OF VARIOUS GASES**

| Common Name | Chemical Formula | Specific Gravity¹ | PEL (OSHA)² | STEL³ | Lethal⁴ |
|--------------------|-------------------------|-------------------------------------|-------------------------------|----------------------------------|---------------------------|
| Hydrogen Cyanide | HCN | 0.94 | 10 | 150 | 300 |
| Hydrogen Sulfide | H ₂ S | 1.18 | 10 | 15 ppm | 600 |
| Sulfur Dioxide | SO ₂ | 2.21 | 2 | 5 ppm | 1000 |
| Chlorine | CL ₂ | 2.45 | 1 | | |
| Carbon Monoxide | CO | 0.97 | 35 | 200/1Hour | 1000 |
| Carbon Dioxide | CO ₂ | 1.52 | 5000 | 5% 10% | |
| Methane | CH ₄ | 0.55 | 90000 (9%) | Combustible (Above 5% in air) | |

¹ **Air = 1.0**

² **Permissible -** Concentration at which is believed that all workers may repeatedly be exposed, day after day, without adverse effect.

³ **STEL -** Short Term Exposure Limit.

⁴ **Lethal -** Concentration that will cause death with short-term exposure.

Ref: API RP-49, September 1974 - Reissued August 1978

SECTION B-1 PROPERTIES OF GASES

A. CARBON DIOXIDE

1. Carbon Dioxide (CO₂) is usually considered inert and is commonly used to extinguish fires. It is 1.52 times heavier than air and will concentrate in low areas of still air. Humans cannot breathe air containing more than 10% CO₂ without losing consciousness. Air containing 5% CO₂ will cause disorientation in a few minutes. Continued exposure to CO₂ after being affected will cause convulsions, coma, and respiratory failure.
2. The threshold limit of CO₂ is 5000 ppm. Short-term exposure to 50,000 ppm (5%) is reasonable. This gas is colorless, odorless, and can be tolerated in relatively high concentrations.

B. HYDROGEN SULFIDE

1. Hydrogen Sulfide (H₂S) is a colorless, transparent, flammable gas. It is heavier than air and, hence, may accumulate in low places.
2. Although the slightest presence of H₂S in the air is normally detectable by its characteristic "rotten egg" odor, it is dangerous to rely on the odor as a means of detecting excessive concentrations because the sense of smell is rapidly lost, allowing lethal concentrations to be accumulated without warning. The following table indicates the poisonous nature of H₂S.

| CONCENTRATION | | | EFFECTS |
|--------------------|------|-------------------------|---|
| % H ₂ S | PPM | GR/100 SCF ¹ | |
| 0.001 | 10 | .65 | Safe for 8 hours without respirator. Obvious and unpleasant odor, but will deaden the sense of smell. |
| 0.0015 | 15 | 0.975 | Safe for 15 minutes of exposure without respirator. |
| 0.01 | 100 | 6.48 | Kills smell in 3-15 minutes; may sting eyes and throat. |
| 0.02 | 200 | 12.96 | Kills smell quickly; stings eyes and throat. |
| 0.05 | 500 | 32.96 | Dizziness; breathing ceases in a few minutes; need prompt artificial respiration. |
| 0.07 | 700 | 45.92 | Rapid Unconsciousness; death will result if not rescued promptly. |
| 0.1 | 1000 | 64.80 | Instant unconsciousness, followed by death within minutes. |

¹ Grains Per 100 Cubic Feet

Treatment Procedures for Hydrogen Sulfide Poisoning

- A. Remove the victim to fresh air.
- B. If breathing has ceased or is labored, begin resuscitation immediately.
Note: This is the quickest and preferred method of clearing victim's lungs of contaminated air; however, under disaster conditions, it may not be practical to move the victim to fresh air. In such instances, where those rendering first aid must continue to wear masks, a resuscitator should be used.
- C. Apply resuscitator to help purge H₂S from the blood stream.
- D. Keep the victim at rest and prevent chilling.
- E. Get victim under physician's care as soon as possible.

C. SULFUR DIOXIDE

- 1. Sulfur Dioxide (SO₂) is a colorless, non-flammable, transparent gas.
- 2. SO₂ is produced during the burning of H₂S. Although SO₂ is heavier than air, it can be picked up by a breeze and carried downwind at elevated temperatures. Since SO₂ is extremely irritating to the eyes and mucous membranes of the upper respiratory tract, it has exceptionally good warning powers in this respect. The following table indicates the toxic nature of SO₂:

| CONCENTRATION | | EFFECTS |
|-------------------|--------|---|
| % SO ₂ | PPM | |
| 0.0005 | 3 to 5 | Pungent odor, normally a person can detect SO ₂ in this range. |
| 0.0012 | 12 | Throat irritation, coughing, constriction of the chest, tearing and smarting of eyes. |
| 0.015 | 150 | So irritating that it can only be endured for a few minutes. |
| .05 | 500 | Causes a sense of suffocation, event with the first breath. |

SECTION B-2

BREATHING AIR EQUIPMENT DRILLS FOR ON-DUTY PERSONNEL

On-duty personnel includes: Rig and Roustabout Crew, Mudlogger, Mud Engineer, OIM, Contractor Medic, H₂S Safety Technician, and the Anadarko Company Representative.

An H₂S Drill and Training Session must be given once a week to ALL on-duty personnel with off duty personnel. On-duty and Off-duty personnel will reverse roles on alternate drills.

The purpose of this drill is to instruct the crews in the operation and use of breathing air and H₂S related emergency equipment and to allow the personnel to become acquainted with using the equipment under working conditions. The crews should be trained to put on the breathing air equipment in a timely manner after an H₂S emergency has been alerted.

The following procedure should be used for weekly drills. The Anadarko Company Representative and OIM must be satisfied that the crews are proficient with the equipment.

Note: The drill will be conducted as outlined under "Emergency Procedures for Condition II and Condition III" Section V.B.

1. All on-board personnel should be informed that a drill will be held.
2. The H₂S Safety Technician should initiate the drill by signaling as he would if he detected H₂S.
3. The driller should shut down the mud pumps and continue to rotate the drill pipe while he and the crew put on their breathing air equipment. The Mudlogger, Mud Engineer, OIM, and Anadarko Company Representative should also don their breathing air equipment.
4. Once the breathing air equipment is on, the Driller should pick up and check for flow.
5. The Driller should proceed as if the well is flowing; simulate closing the well in, but DO NOT ACTUALLY CLOSE THE BOP's.
6. The Mudlogger should continue to monitor his mudlogging equipment with his breathing air equipment on.

7. The Mud Engineer should perform a flowline check for mud weight and funnel viscosity and catch a mud sample for a sulfides test on the mud. This part of the drill is important, as Anadarko Company wants to make it a standard practice that a sulfides test be run every time anything unusual happens. In DRILL ONLY it may not be necessary to perform the sulfides test on the mud.
8. During the Drill the Anadarko Company Representative, OIM, and the H₂S Safety Technician will observe to make sure that everyone is using their equipment properly. The H₂S Technician may conduct the drill without an SCBA on allowing him/her to make better observations of drill performance. This will allow the H₂S Technician to coach/teach proper techniques during the drill thereby improving the response times.
9. Resume normal operations.
10. The OIM, Anadarko Company Representative, and the H₂S Safety Technician shall hold a post drill review to discuss results of the drill with those participating.

SECTION B-3

BREATHING AIR EQUIPMENT DRILLS AND TRAINING SESSIONS FOR OFF-DUTY PERSONNEL

Off-duty personnel include all personnel aboard the Rig with the exception of the On-Duty Rig and Roustabout Crew, Mudlogger, Mud Engineer, OIM, Contractor Medic, H₂S Safety Technician, and the Anadarko Company Representative.

An H₂S drill and training session must be given once a week to all off-duty personnel in coincidence with on-duty personnel reversing roles on alternate drills.

This training will be conducted to instruct personnel in the operation and use of self-contained breathing apparatus and H₂S related emergency equipment, and to review various operating procedures in the "H₂S Contingency Plan".

Initial Drills should include:

1. General information about the self-contained breathing apparatus (SCBA), including air supply time limit, connection to breathing air manifold, and proper packing and storage. **Spectacle Kits for SCBA's should be utilized in place of contact lenses or spectacles.**
2. How to put the mask on and test for leaks around face and hose connections. **All personnel will be informed of the restrictions against having beards.**

These drills should be conducted as often as necessary to acquaint the crews with the equipment. After the Anadarko Company Representative and the OIM are convinced that all personnel are trained, a weekly drill must be conducted. This drill may be initiated any time. Prior to the drill, the Rig crew on duty must be informed that it is only a practice drill. The drill will be initiated by the Condition II or Condition III general alarm signal given by the OIM or the Anadarko Company Representative. At this time, all off-duty personnel will immediately get their assigned SCBA's and report to the "Safe Briefing Area". Personnel should be trained to report to the designated "safe briefing area" with their emergency equipment in a timely manner after the alarm has sounded. A training and information session will be conducted after each drill to answer any H₂S related questions and to cover one or more of the following:

- Condition I, II, and III alerts and steps to be taken by all personnel.
- The importance of wind direction when dealing with H₂S.
- Proper use and storage of all types of breathing equipment.
- Proper use and storage of oxygen resuscitators.
- Proper use and storage of H₂S detectors (Gastec Detector, Ampoules, Spot Checks).
- The "buddy system" and the procedure for rescuing a person overcome by H₂S.
- Responsibilities and duties.
- Location of H₂S safety equipment.
- Other parts of the "H₂S Contingency Plan" that should be reviewed.

NOTE: A record of attendance must be kept for weekly drills and training sessions. These drills must also be documented on the IADC Report and the Anadarko Company Drilling Morning Report.

SECTION B-4

HYDROGEN SULFIDE TRAINING CURRICULUM

AT THE DOCKS AND ON THE RIG; EACH INDIVIDUAL WILL BE ASKED IF THEY HAVE BEEN CLEARED BY A PHYSICIAN TO USE A RESPIRATOR.

EACH PERSON WILL BE INFORMED ON THE RESTRICTIONS OF HAVING BEARDS. THEY WILL ALSO BE INFORMED OF THE AVAILABILITY OF SPECTACLE KITS.

THE SAFETY PROGRAM IS OUTLINED IN THE H2S CONTINGENCY PLAN. THIS PLAN WILL BE AVAILABLE ON THE RIG. EACH INDIVIDUAL WILL BE TRAINED ON THE MATERIAL CONTAINED IN THE H2S CONTINGENCY PLAN.

AFTER THE H2S EQUIPMENT IS RIGGED UP, ALL PERSONNEL WILL BE H2S TRAINED AND PUT THROUGH A DRILL. ANY DEFICIENCIES WILL BE CORRECTED.

Training Completion cards are good for one year and will indicate date of completion or expiration. Personnel previously trained on another facility and visiting the facility or Rig must attend a "supplemental briefing" on H2S equipment and procedures before beginning duty. Visitors who remain on the facility more than 24 hours must receive full H2S training given all crew members. A "supplemental briefing" will include but not be limited to: Location, use and donning of an assigned respirator, familiarization with safe briefing areas, alarms with instruction on responsibilities in the event of a release and hazards of H2S and SO2.

Topics for full H2S training shall include, but not be limited to the following:

- I. **Brief Introduction on H2S**
 - A. Slide or VCR presentation (If Available)
 - B. H2S material will be distributed
 - C. Re-emphasize the properties, toxicity, and hazards of H2S
 - D. Source of SO2

- II. **H2S Detection**
 - A. Description of H2S sensors
 - B. Description of warning system (how it works & it's location)
 - C. Actual location of H2S sensors
 - D. Instruction on use of pump type detector (Gastec)
 - E. Use of card detectors, ampoules, or dosimeters
 - F. Use of combustible gas detector

- G. Other personnel detectors used
 - H. Alarm conditions I, II, & III (5ppm, 10ppm, 50ppm)
 - I. SO₂ (2ppm and 5ppm)
- III. **H2S Protection**
- A. Types of breathing apparatus provided (30-minute SCBA & SKA PAK with **voice diaphragms for communication**)
 - B. Principle of how breathing apparatus works
 - C. Demonstration on how to use breathing apparatus
 - D. Location of breathing apparatus
- IV. **Cascade System**
- A. Description of cascade system
 - B. How system works
 - C. Cascade location of Rig with reference to briefing areas
 - D. How to use cascade system (with SKA PAKS & refill)
 - E. Importance of wind direction and actual location of windsocks
 - F. Purpose of compressor/function
- V. **H2S Rescue and First Aid**
- A. Importance of wind direction
 - B. Safe briefing area
 - C. Buddy system
 - D. H₂S symptoms
 - E. Methods of rescue
- VI. **Hands on Training**
- A. Donning/familiarization of SCBA
 - B. Donning/familiarization of SKA PAK
 - C. Familiarization of cascades
 - D. Use of O₂ resuscitator
 - E. Alarm conditions - upwind briefing areas, etc...
 - F. Duties and responsibilities of all personnel
 - G. Procedures for evacuation
 - H. Search and Rescue teams
- VII. **Certification**
- A. Testing on material covered
- VIII. **ALL TRAINING AND DRILLS WILL INCLUDE ATTENDANT VESSELS. ALL PERSONNEL ON ATTENDANT VESSELS WILL HAVE A SELF-CONTAINED BREATHING APPARATUS. HELICOPTERS WILL BE AVAILABLE FOR STAND-BY IF ON RIG.**

TOTAL SAFETY FIT TESTING

EMPLOYEE INFORMATION

Employee Name: _____ Date: _____

Date of Employee Medical Evaluation: _____

Medical Status (Circle) Unrestricted Limitations on Use Use Not Authorized

RESPIRATOR INFORMATION

Respirator Type (Dustmask, SCBA, etc.): _____

Brand: _____

Model: _____

Size (Circle): XS S M L XL

FIT TEST INFORMATION

Type of Fit Test Performed:

QUANTITATIVE

PortaCount
Fittester 3000

Fit Factor: _____
Fit Factor: _____

QUALITATIVE

Irritant Smoke
Isoamyl Acetate (Banana Oil)
Saccharin
Bitrex

Passed/Failed _____
Passed/Failed _____
Passed/Failed _____
Passed/Failed _____

I hereby certify that this fittest was conducted in accordance with the OSHA Fit Testing Protocols found in Appendix A of 1910.134.

Fit Tester Name (Print) _____

Signature: _____ Date: _____

**SECTION B-5
EMERGENCY TELEPHONE LISTING**

All Contacts will be updated on an annual basis

MEDI-VAC/NIGHT FLIGHTS

| | |
|---|--------------------------------------|
| ERA (Fourchon, LA & Galveston, TX) | 800-655-1414 337-478-6131 |
| Cougar (Galliano, LA) | 855-844-2367 |
| Bristow (Galliano, LA) | 800-365-6771 337-335-2246 |
| AIR MED (Lafayette, LA) | 800-259-1111 |
| UNITED STATES COAST GUARD GULF OF MEXICO | 504-589-6225 |
| UNITED STATES COAST GUARD NEW ORLEANS, LOUISIANA | 504-589-6225 |

HOSPITALS

| | |
|---|---------------------|
| ABBEVILLE GENERAL HOSPITAL 118 N. Hospital Drive, Abbeville, LA 70510 | 337-893-5466 |
| LAFAYETTE GENERAL MEDICAL CENTER 1214 Coolidge Street, Lafayette, LA 70503 | 337-289-7991 |
| OUR LADY OF LOURDES 4801 Ambassador Caffery, Lafayette, LA 70518 | 337-470-2000 |
| IBERIA GENERAL HOSPITAL 2315 East Main, New Iberia, LA | 337-364-0441 |

AMBULANCE

| | |
|----------------------------------|------------|
| ACADIAN AMBULANCE SERVICE | 911 |
|----------------------------------|------------|

OPERATOR

Anadarko Petroleum Corporation
1201 Lake Robbins Dr
The Woodlands, TX 77380

Main Office 832-636-1000

Bob Quitzau, Drilling Engineer

Office 832-636-1551
Cell 281-380-1298

Steve Woelfel, Drilling Supt.

Office 832-636-3104
Cell 713-865-6371

Pat Watson, Drilling Manager

Office 832-636-3903
Cell 713-898-2621

Jack Amberge, EHS Manager

Office 832-636-8736
Cell 713-822-8113

Anadarko on Site Drilling Foreman

Office 832-636-9310

Anadarko on Site Dispatcher

Office 832-636-9311

DRILLING COMPANY

ENSCO
16300 Katy Freeway
Houston, TX

Main Office 281-809-0400

Semi Submersible "Rig 8506"

Main Phone: 281-677-5687
Or 281-677-5682

ENSCO 8506 OIM

Office 281-677-5683

Robert Strong, Rig Manager

Office: 281-809-0454
Cell: 281-217-9568
Email: rstrong@enscoplc.com

H₂S SAFETY SERVICES

Total Safety

Office 800-824-4250
337-837-1888

Sean Chamblee, Sales Representative

Cell 713-703-6295

Ross Neal, Manager

Office 337-837-1888
Cell 337-230-2833

**DEPARTMENT OF THE INTERIOR
BOEMRE**

| District | Role | Name | Phone # | Email Address |
|------------------------|--------------------------------------|--------------------|--------------|--|
| New Orleans | General Number | Office | 504-734-6740 | After Hours # 504-615-0114 |
| 990 N. Corporate Drive | District Manager | David Trocquet | 504-734-6740 | David.Trocquet@bsee.gov |
| Suite 100 | Production Operations Section Chief | Stephen P. Dessaur | 504-734-6747 | stephen.dessaur2@bsee.gov |
| New Orleans, LA | Drilling Engineer | Mark Hasenkampf | 504-734-6754 | mark.hasenkampf@bsee.gov |
| | Well Operations Section Chief | Lynard Carter | 504-734-6746 | Lynard.carter@bsee.gov |
| 70123-2394 | Drilling Engineer | Christopher Adams | 504-734-6777 | Christopher.adams@bsee.gov |
| | Work Over/Completions Engineer | Tom Meyer | 504-734-6745 | tom.meyer@bsee.gov |
| | Work Over/Completions Engineer | Paul Barbre | 504-734-6773 | paul.barbre@bsee.gov |
| | Work Over/Completions Field Engineer | Joe Butts | 504-736-2577 | Joe.butts@bsee.gov |
| | Chief, Production | | 504-734-6747 | stephen.dessaur2@bsee.gov |
| | Drilling Field Engineer | John Severson | 504-734-6402 | john.severson@bsee.gov |
| | Drilling Supervisor Inspector | Justin Josey | 504-734-6755 | justin.josey@bsee.gov |
| | Production Supervisory Inspector | Vacant | | |
| | Production Engr | Otho Barnes | 754-734-6749 | Otho.barnes@bsee.gov |
| | Production Engineer | Ashton Blazquez | 504-734-6757 | Ash ton.blazquez@bsee.gov |
| | Production Lead Inspector | David Emilien | 504-734-6759 | David.emilien@bsee.gov |
| | Drilling Lead Inspector | Dan Phelps | 504-734-6774 | Dan.phelps@bsee.gov |
| | Admin. Support Asst. | Suzie Winstead | 504-734-6742 | suzanne.winstead@bsee.gov |
| | File Clerk Office Assistant | Debra Williams | 504-734-6740 | debra.williams@bsee.gov |
| | Petroleum Eng Tech | Ana Blazquez | 504-734-6751 | ana.blazquez@bsee.gov |

UNITED STATES COAST GUARD

| | |
|--|---------------------|
| National Response Center | 800/424-8802 |
| Washington, D.C. | 202/267-2675 |
| New Orleans, Louisiana | 504/589-6225 |
| Venice, Louisiana (Oil Spills & Collisions) | 985/534-2332 |

FEDERAL AVIATION ADMINISTRATION

Houston Air Traffic Control/Traffic Management

OFFICE: 281-230-5560

(In the event of an above-water or below-water sour gas release greater than 100 SCF, notify the FAA that air traffic (except evacuation and medical aircraft) should be routed safely away from the site until further notice. For purposes of avoidance recommendations to the FAA, a distance of 10 nautical miles and an altitude of 4,000 feet, as minimal, shall be used.

SECTION B-6

KEY PERSONNEL TO REMAIN ABOARD DURING PARTIAL EVACUATION

This is a suggested list of minimum personnel to remain on location; however, wellsite conditions may dictate that an alternative list be followed.

Rig Crew On-Duty:

- 1 - Driller
- 3 - Floormen
- 1 - Derrickman
- 1 - Mudman

Other Personnel: (as required)

- 1 - H₂S Safety Technician
- 1 - Crane Operator
- 4 - Roustabouts
- 1 - Mechanic
- 1 - Drilling Contractor Medic
- 1 - Barge Engineer
- 1 - Electrician
- 1 - Mud Engineer
- 1 - Cementer

Supervisory Personnel:

- 2 - Anadarko Company Representatives
- 1 - OIM
- 1 - Toolpusher

NOTE: Once the emergency is clearly defined, the above personnel should then be transferred to the crew boats if they will not be needed.

APPENDIX SECTION C

Equipment List and Inventory

Rig Equipment

H2S Detection System

(The Rigs H2S Detection System will be utilized)

H2S004 First Floor AHU Intake
H2S007 Drillers Cabin (By Drawworks)
H2S009 Flow Line Primer (Gumbo Box)
H2S014 Mud Pits (Pit 2)
H2S015 Mud Pits (Pit 7)
H2S016 Shale Shakers
H2S020 Well Center AFT (Main Deck Moon Pool)
H2S022 Well Center FWD (Main Deck Moon Pool)

2 Portable H2S/LEL/O2 Gas Detector
2 Sensydyne Sampling Pump with Assorted Tubes
150 Personal H2S Detectors (Crickets)
2 H2S Calibration Gas Cylinders

Breathing Air System

225 30 Minute Self Contained Breathing Apparatus with Case
20 5 Minute Self Contained Breathing Apparatus (work units)
10 8 Bottle Cascade System
3 6 Bottle Cascade Systems
2 300 Cubic Cylinder
20 Regulators
2 Breathing Air Compressors
24 Twelve Man Reserve Manifold
10 Six Man Reserve Manifolds
4 Three Man Reserve Manifolds
2 8' Filler Whip
4 100' L.P. Breathing Air Hose
34 50' L.P. Breathing Air Hose
292 5' L.P. Breathing Air Hose
20 Isolation Valves

Safety Equipment

2 Wind Sock, Frame, & Pole
3 O2 Resuscitator
4 White Marker Boards
4 Notepads and Pencil Sets
4 4' X 8' Marine Signs
10 Operating Condition Signs for Work Areas
3 Flashlights
1 Flare Pistol w/Flares
6 Throat Mic

- 3 Safety Harnesses w/100' Safety Line
- 1 First Aid Kit
- 2 Primary Briefing Area Sign
- 2 Secondary Briefing Area Sign
- 1 Well Test Flare Boom
- 1 Litter

Evacuation Boat Equipment (Actual quantities to match POB for each M/V) 1 Boat

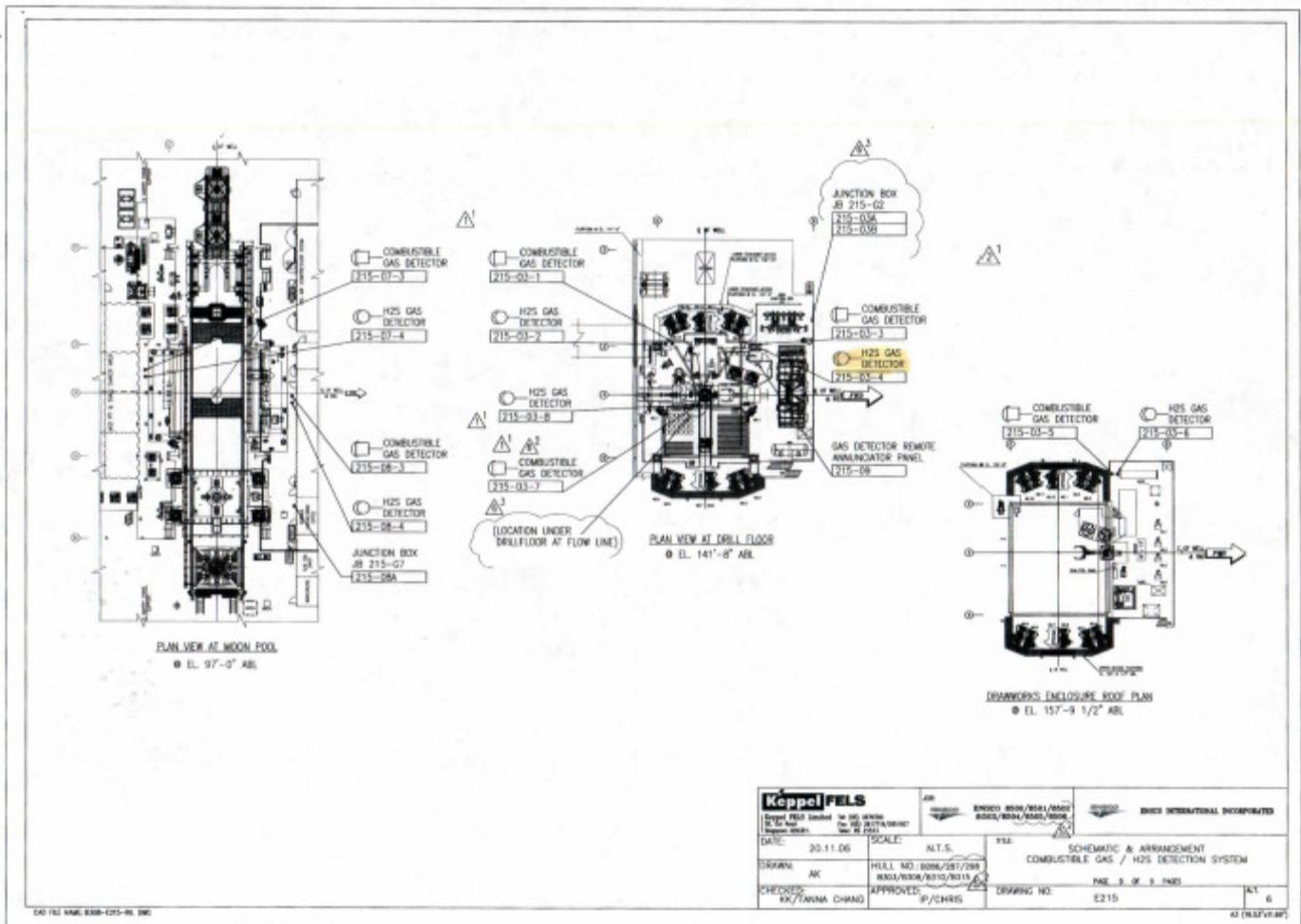
- 13 30 Minute SCBA
- 2 8 Bottle Cascade Rack
- 12 12 Man Manifold
- 10 50' LP Hose
- 150 LP Pigtails
- 1 H2S Fixed Sensor Single Point System
- 1 H2S Alarm Station – Audible/Visual
- 13 Personal H2S Monitors (Qty to match number of personnel on each M/V)

Work Boat Equipment (Actual quantities to match POB for each M/V) 2 Boats

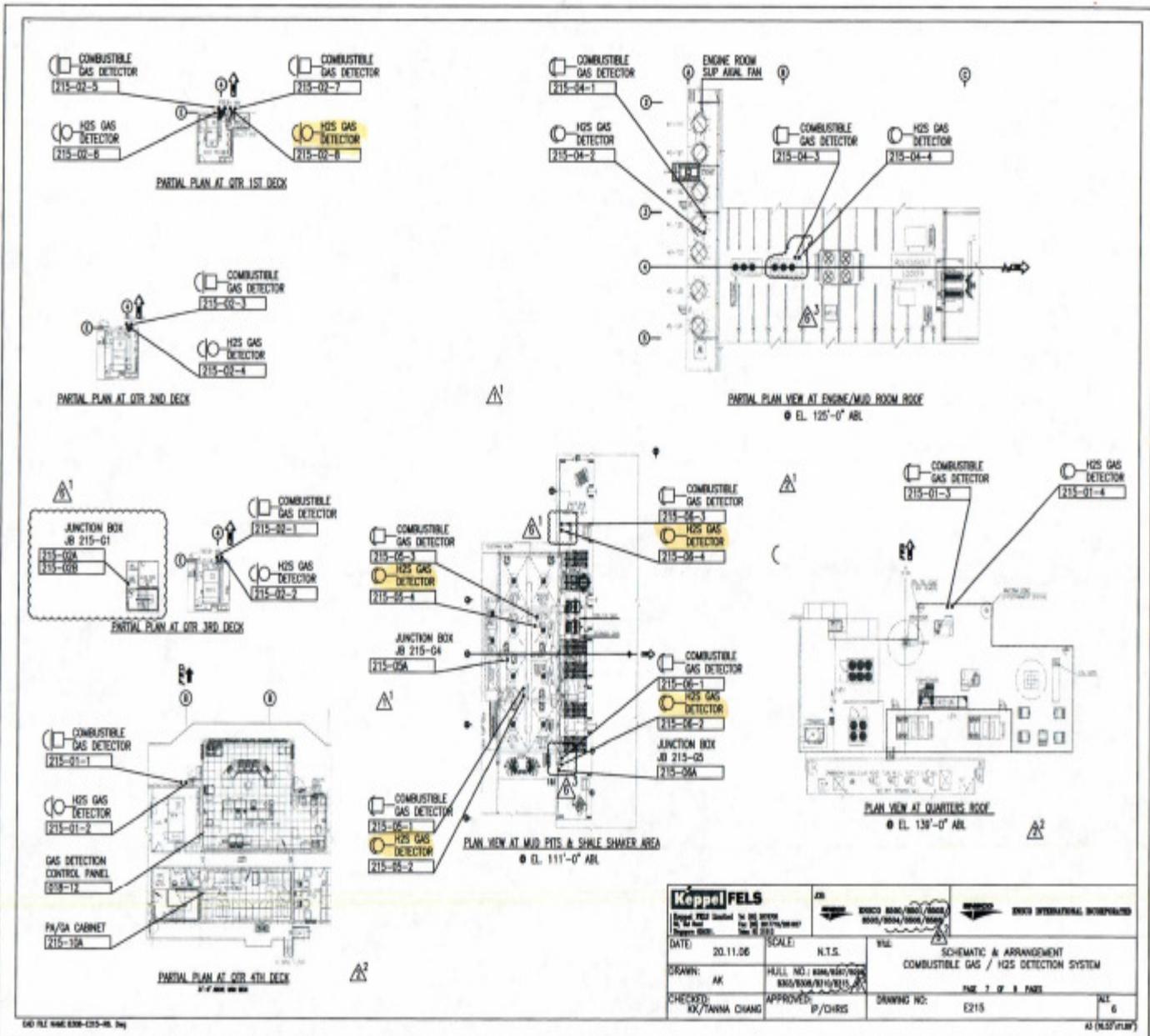
- 6 30 Minute SCBA
- 1 8 Bottle Cascade Rack
- 1 6 Man Manifold
- 2 100' LP Hose
- 4 50' LP Hose
- 6 LP Pigtails
- 1 H2S Fixed Sensor Single Point System
- 1 H2S Alarm Station – Audible/Visual
- 6 Personal H2S Monitors (Qty to match number of personnel on each M/V)

APPENDIX SECTION D

Rig Drawings



| | | | | | |
|-------------------------|--|--|--|--|--|
| Keppel FELS | | ENGGD 8006/8081/8086/8087/8088/8089/8090/8091/8092/8093/8094/8095/8096/8097/8098/8099/8100 | | ENGGD 8006/8081/8086/8087/8088/8089/8090/8091/8092/8093/8094/8095/8096/8097/8098/8099/8100 | |
| DATE: 20.11.06 | | SCALE: N.T.S. | | TITLE: SCHEMATIC & ARRANGEMENT | |
| DRAWN: AK | | HULL NO.: 8086/8087/8088/8089/8090/8091/8092/8093/8094/8095/8096/8097/8098/8099/8100 | | COMBUSTIBLE GAS / H2S DETECTION SYSTEM | |
| CHECKED: KY/TANWA CHANG | | APPROVED: P/CHRIS | | DRAWING NO.: E215 | |
| | | | | PAGE 3 OF 3 PAGES | |
| | | | | REV. 6 | |



APPENDIX SECTION E

Rules and Regulations

Bureau of Safety and Environmental Enforcement CFR 30, 250.490

§ 250.490 Hydrogen sulfide.

(a) *What precautions must I take when operating in an H 2S area?* You must:

- (1) Take all necessary and feasible precautions and measures to protect personnel from the toxic effects of H 2S and to mitigate damage to property and the environment caused by H 2S. You must follow the requirements of this section when conducting drilling, well-completion/well-workover, and production operations in zones with H 2S present and when conducting operations in zones where the presence of H 2S is unknown. You do not need to follow these requirements when operating in zones where the absence of H 2S has been confirmed; and
- (2) Follow your approved contingency plan.

(b) *Definitions.* Terms used in this section have the following meanings:

Facility means a vessel, a structure, or an artificial island used for drilling, well-completion, well-workover, and/or production operations.

H 2S absent means:

- (1) Drilling, logging, coring, testing, or producing operations have confirmed the absence of H 2S in concentrations that could potentially result in atmospheric concentrations of 20 ppm or more of H 2S; or
- (2) Drilling in the surrounding areas and correlation of geological and seismic data with equivalent stratigraphic units have confirmed an absence of H 2S throughout the area to be drilled.

H 2S present means that drilling, logging, coring, testing, or producing operations have confirmed the presence of H 2S in concentrations and volumes that could potentially result in atmospheric concentrations of 20 ppm or more of H 2S.

H 2S unknown means the designation of a zone or geologic formation where neither the presence nor absence of H 2S has been confirmed.

Well-control fluid means drilling mud and completion or workover fluid as appropriate to the particular operation being conducted.

(c) *Classifying an area for the presence of H 2S.* You must:

- (1) Request and obtain an approved classification for the area from the Regional Supervisor before you begin operations. Classifications are "H 2S absent," "H 2S present," or "H 2S unknown";
- (2) Submit your request with your application for permit to drill;

- (3) Support your request with available information such as geologic and geophysical data and correlations, well logs, formation tests, cores and analysis of formation fluids; and
- (4) Submit a request for reclassification of a zone when additional data indicate a different classification is needed.
- (d) *What do I do if conditions change?* If you encounter H₂S that could potentially result in atmospheric concentrations of 20 ppm or more in areas not previously classified as having H₂S present, you must immediately notify BSEE and begin to follow requirements for areas with H₂S present.
- (e) *What are the requirements for conducting simultaneous operations?* When conducting any combination of drilling, well-completion, well-workover, and production operations simultaneously, you must follow the requirements in the section applicable to each individual operation.
- (f) *Requirements for submitting an H₂S Contingency Plan.* Before you begin operations, you must submit an H₂S Contingency Plan to the District Supervisor for approval. Do not begin operations before the District Supervisor approves your plan. You must keep a copy of the approved plan in the field, and you must follow the plan at all times. Your plan must include:
- (1) Safety procedures and rules that you will follow concerning equipment, drills, and smoking;
 - (2) Training you provide for employees, contractors, and visitors;
 - (3) Job position and title of the person responsible for the overall safety of personnel;
 - (4) Other key positions, how these positions fit into your organization, and what the functions, duties, and responsibilities of those job positions are;
 - (5) Actions that you will take when the concentration of H₂S in the atmosphere reaches 20 ppm, who will be responsible for those actions, and a description of the audible and visual alarms to be activated;
 - (6) Briefing areas where personnel will assemble during an H₂S alert. You must have at least two briefing areas on each facility and use the briefing area that is upwind of the H₂S source at any given time;
 - (7) Criteria you will use to decide when to evacuate the facility and procedures you will use to safely evacuate all personnel from the facility by vessel, capsule, or lifeboat. If you use helicopters during H₂S alerts, describe the types of H₂S emergencies during which you consider the risk of helicopter activity to be acceptable and the precautions you will take during the flights;
 - (8) Procedures you will use to safely position all vessels attendant to the facility. Indicate where you will locate the vessels with respect to wind direction. Include the distance from the facility and what procedures you will use to safely relocate the vessels in an emergency;
 - (9) How you will provide protective-breathing equipment for all personnel, including contractors and visitors;
 - (10) The agencies and facilities you will notify in case of a release of H₂S (that constitutes an emergency), how you will notify them, and their telephone numbers. Include all facilities that might be exposed to atmospheric concentrations of 20 ppm or more of H₂S;
 - (11) The medical personnel and facilities you will use if needed, their addresses, and telephone numbers;

- (12) H₂S detector locations in production facilities producing gas containing 20 ppm or more of H₂S. Include an "H₂S Detector Location Drawing" showing:
- (i) All vessels, flare outlets, wellheads, and other equipment handling production containing H₂S;
 - (ii) Approximate maximum concentration of H₂S in the gas stream; and
 - (iii) Location of all H₂S sensors included in your contingency plan;
- (13) Operational conditions when you expect to flare gas containing H₂S including the estimated maximum gas flow rate, H₂S concentration, and duration of flaring;
- (14) Your assessment of the risks to personnel during flaring and what precautionary measures you will take;
- (15) Primary and alternate methods to ignite the flare and procedures for sustaining ignition and monitoring the status of the flare (i.e., ignited or extinguished);
- (16) Procedures to shut off the gas to the flare in the event the flare is extinguished;
- (17) Portable or fixed sulphur dioxide (SO₂)-detection system(s) you will use to determine SO₂ concentration and exposure hazard when H₂S is burned;
- (18) Increased monitoring and warning procedures you will take when the SO₂ concentration in the atmosphere reaches 2 ppm;
- (19) Personnel protection measures or evacuation procedures you will initiate when the SO₂ concentration in the atmosphere reaches 5 ppm;
- (20) Engineering controls to protect personnel from SO₂; and
- (21) Any special equipment, procedures, or precautions you will use if you conduct any combination of , well-drilling, well-workover, and production operations simultaneously.
- (g) *Training program.*
- (1) *When and how often do employees need to be trained?* All operators and contract personnel must complete an H₂S training program to meet the requirements of this section:
- (i) Before beginning work at the facility; and
 - (ii) Each year, within 1 year after completion of the previous class.
- (2) *What training documentation do I need?* For each individual working on the platform, either:
- (i) You must have documentation of this training at the facility where the individual is employed; or
 - (ii) The employee must carry a training completion card.
- (3) *What training do I need to give to visitors and employees previously trained on another facility?*
- (i) Trained employees or contractors transferred from another facility must attend a supplemental briefing on your H₂S equipment and procedures before beginning duty at your facility;

(ii) Visitors who will remain on your facility more than 24 hours must receive the training required for employees by paragraph (g)(4) of this section; and

(iii) Visitors who will depart before spending 24 hours on the facility are exempt from the training required for employees, but they must, upon arrival, complete a briefing that includes:

(A) Information on the location and use of an assigned respirator; practice in donning and adjusting the assigned respirator; information on the safe briefing areas, alarm system, and hazards of H₂S and SO₂; and

(B) Instructions on their responsibilities in the event of an H₂S release.

(4) *What training must I provide to all other employees?* You must train all individuals on your facility on the:

(i) Hazards of H₂S and of SO₂ and the provisions for personnel safety contained in the H₂S Contingency Plan;

(ii) Proper use of safety equipment which the employee may be required to use;

(iii) Location of protective breathing equipment, H₂S detectors and alarms, ventilation equipment, briefing areas, warning systems, evacuation procedures, and the direction of prevailing winds;

(iv) Restrictions and corrective measures concerning beards, spectacles, and contact lenses in conformance with ANSI Z88.2, American National Standard for Respiratory Protection (incorporated by reference as specified in § 250.198);

(v) Basic first-aid procedures applicable to victims of H₂S exposure. During all drills and training sessions, you must address procedures for rescue and first aid for H₂S victims;

(vi) Location of:

(A) The first-aid kit on the facility;

(B) Resuscitators; and

(C) Litter or other device on the facility.

(vii) Meaning of all warning signals.

(5) *Do I need to post safety information?* You must prominently post safety information on the facility and on vessels serving the facility (i.e., basic first-aid, escape routes, instructions for use of life boats, etc.).

(h) *Drills. (1) When and how often do I need to conduct drills on H₂S safety discussions on the facility?* You must:

(i) Conduct a drill for each person at the facility during normal duty hours at least once every 7-day period. The drills must consist of a dry-run performance of personnel activities related to assigned jobs.

(ii) At a safety meeting or other meetings of all personnel, discuss drill performance, new H₂S considerations at the facility, and other updated H₂S information at least monthly.

(2) *What documentation do I need?* You must keep records of attendance for:

(i) Completion, well-completion, and well-workover operations at the facility until operations are completed; and

(ii) Production operations at the facility or at the nearest field office for 1 year.

(i) *Visual and audible warning systems -- (1) How must I install wind direction equipment?* You must install wind-direction equipment in a location visible at all times to individuals on or in the immediate vicinity of the facility.

(2) *When do I need to display operational danger signs, display flags, or activate visual or audible alarms?*

(i) You must display warning signs at all times on facilities with wells capable of producing H₂S and on facilities that process gas containing H₂S in concentrations of 20 ppm or more.

(ii) In addition to the signs, you must activate audible alarms and display flags or activate flashing red lights when atmospheric concentration of H₂S reaches 20 ppm.

(3) *What are the requirements for signs?* Each sign must be a high-visibility yellow color with black lettering as follows:

| Letter height | Wording |
|---|--|
| 12 inches..... | Danger. Poisonous Gas. Hydrogen Sulfide. |
| 7 inches..... | Do not approach if red flag is flying. |
| (Use appropriate wording at right)..... | Do not approach if red lights are flashing. |

(4) *May I use existing signs?* You may use existing signs containing the words "Danger-Hydrogen Sulfide-H₂S," provided the words "Poisonous Gas. Do Not Approach if Red Flag is Flying" or "Red Lights are Flashing" in lettering of a minimum of 7 inches in height are displayed on a sign immediately adjacent to the existing sign.

(5) *What are the requirements for flashing lights or flags?* You must activate a sufficient number of lights or hoist a sufficient number of flags to be visible to vessels and aircraft. Each light must be of sufficient intensity to be seen by approaching vessels or aircraft any time it is activated (day or night). Each flag must be red, rectangular, a minimum width of 3 feet, and a minimum height of 2 feet.

(6) *What is an audible warning system?* An audible warning system is a public address system or siren, horn, or other similar warning device with a unique sound used only for H₂S.

(7) *Are there any other requirements for visual or audible warning devices?* Yes, you must:

(i) Illuminate all signs and flags at night and under conditions of poor visibility; and

(ii) Use warning devices that are suitable for the electrical classification of the area.

(8) *What actions must I take when the alarms are activated?* When the warning devices are activated, the designated responsible persons must inform personnel of the level of danger and issue instructions on the initiation of appropriate protective measures.

(j) *H₂S-detection and H₂S monitoring equipment* -- (1) *What are the requirements for an H₂S detection system?* An H₂S detection system must:

- (i) Be capable of sensing a minimum of 10 ppm of H₂S in the atmosphere; and
- (ii) Activate audible and visual alarms when the concentration of H₂S in the atmosphere reaches 20 ppm.

(2) *Where must I have sensors for completion, well-completion, and well-workover operations?* You must locate sensors at the:

- (i) Bell nipple;
- (ii) Mud-return line receiver tank (possum belly);
- (iii) Pipe-trip tank;
- (iv) Shale shaker;
- (v) Well-control fluid pit area;
- (vi) Driller's station;
- (vii) Living quarters; and
- (viii) All other areas where H₂S may accumulate.

(3) *Do I need mud sensors?* The District Supervisor may require mud sensors in the possum belly in cases where the ambient air sensors in the mud-return system do not consistently detect the presence of H₂S.

(4) *How often must I observe the sensors?* During completion, well-completion and well-workover operations, you must continuously observe the H₂S levels indicated by the monitors in the work areas during the following operations:

- (i) When you pull a wet string of drill pipe or workover string;
- (ii) When circulating bottoms-up after a completion break;
- (iii) During cementing operations;
- (iv) During logging operations; and
- (v) When circulating to condition mud or other well-control fluid.

(5) *Where must I have sensors for production operations?* On a platform where gas containing H₂S of 20 ppm or greater is produced, processed, or otherwise handled:

- (i) You must have a sensor in rooms, buildings, deck areas, or low-laying deck areas not otherwise covered by paragraph (j)(2) of this section, where atmospheric concentrations of H₂S could reach 20 ppm or more. You must have at least one sensor per 400 square feet of deck area or fractional part of 400 square feet;
- (ii) You must have a sensor in buildings where personnel have their living quarters;

(iii) You must have a sensor within 10 feet of each vessel, compressor, wellhead, manifold, or pump, which could release enough H₂S to result in atmospheric concentrations of 20 ppm at a distance of 10 feet from the component;

(iv) You may use one sensor to detect H₂S around multiple pieces of equipment, provided the sensor is located no more than 10 feet from each piece, except that you need to use at least two sensors to monitor compressors exceeding 50 horsepower;

(v) You do not need to have sensors near wells that are shut in at the master valve and sealed closed;

(vi) When you determine where to place sensors, you must consider:

(A) The location of system fittings, flanges, valves, and other devices subject to leaks to the atmosphere; and

(B) Design factors, such as the type of decking and the location of fire walls; and

(vii) The District Supervisor may require additional sensors or other monitoring capabilities, if warranted by site specific conditions.

(6) How must I functionally test the H₂S Detectors?

(i) Personnel trained to calibrate the particular H₂S detector equipment being used must test detectors by exposing them to a known concentration in the range of 10 to 30 ppm of H₂S.

(ii) If the results of any functional test are not within 2 ppm or 10 percent, whichever is greater, of the applied concentration, recalibrate the instrument.

(7) How often must I test my detectors?

(i) When conducting completion, drill stem testing, well-completion, or well-workover operations in areas classified as H₂S present or H₂S unknown, test all detectors at least once every 24 hours. When completion, begin functional testing before the bit is 1,500 feet (vertically) above the potential H₂S zone.

(ii) When conducting production operations, test all detectors at least every 14 days between tests.

(iii) If equipment requires calibration as a result of two consecutive functional tests, the District Supervisor may require that H₂S-detection and H₂S-monitoring equipment be functionally tested and calibrated more frequently.

(8) What documentation must I keep?

(i) You must maintain records of testing and calibrations (in the completion or production operations report, as applicable) at the facility to show the present status and history of each device, including dates and details concerning:

(A) Installation;

(B) Removal;

(C) Inspection;

(D) Repairs;

(E) Adjustments; and

(F) Reinstallation.

(ii) Records must be available for inspection by BSEE personnel.

(9) *What are the requirements for nearby vessels?* If vessels are stationed overnight alongside facilities in areas of H₂S present or H₂S unknown, you must equip vessels with an H₂S-detection system that activates audible and visual alarms when the concentration of H₂S in the atmosphere reaches 20 ppm. This requirement does not apply to vessels positioned upwind and at a safe distance from the facility in accordance with the positioning procedure described in the approved H₂S Contingency Plan.

(10) *What are the requirements for nearby facilities?* The District Supervisor may require you to equip nearby facilities with portable or fixed H₂S detector(s) and to test and calibrate those detectors. To invoke this requirement, the District Supervisor will consider dispersion modeling results from a possible release to determine if 20 ppm H₂S concentration levels could be exceeded at nearby facilities.

(11) *What must I do to protect against SO₂ if I burn gas containing H₂S?* You must:

(i) Monitor the SO₂ concentration in the air with portable or strategically placed fixed devices capable of detecting a minimum of 2 ppm of SO₂;

(ii) Take readings at least hourly and at any time personnel detect SO₂ odor or nasal irritation;

(iii) Implement the personnel protective measures specified in the H₂S Contingency Plan if the SO₂ concentration in the work area reaches 2 ppm; and

(iv) Calibrate devices every 3 months if you use fixed or portable electronic sensing devices to detect SO₂.

(12) *May I use alternative measures?* You may follow alternative measures instead of those in paragraph (j)(11) of this section if you propose and the Regional Supervisor approves the alternative measures.

(13) *What are the requirements for protective-breathing equipment?* In an area classified as H₂S present or H₂S unknown, you must:

(i) Provide all personnel, including contractors and visitors on a facility, with immediate access to self-contained pressure-demand-type respirators with hose-line capability and breathing time of at least 15 minutes.

(ii) Design, select, use, and maintain respirators in conformance with ANSI Z88.2 (incorporated by reference as specified in § 250.198).

(iii) Make available at least two voice-transmission devices, which can be used while wearing a respirator, for use by designated personnel.

(iv) Make spectacle kits available as needed.

(v) Store protective-breathing equipment in a location that is quickly and easily accessible to all personnel.

(vi) Label all breathing-air bottles as containing breathing-quality air for human use.

(vii) Ensure that vessels attendant to facilities carry appropriate protective-breathing equipment for each crew member. The District Supervisor may require additional protective-breathing equipment on certain vessels attendant to the facility.

(viii) During H₂S alerts, limit helicopter flights to and from facilities to the conditions specified in the H₂S Contingency Plan. During authorized flights, the flight crew and passengers must use pressure-demand-type respirators. You must train all members of flight crews in the use of the particular type(s) of respirator equipment made available.

(ix) As appropriate to the particular operation(s), (production, completion, well-completion or well-workover operations, or any combination of them), provide a system of breathing-air manifolds, hoses, and masks at the facility and the briefing areas. You must provide a cascade air-bottle system for the breathing-air manifolds to refill individual protective-breathing apparatus bottles. The cascade air-bottle system may be recharged by a high-pressure compressor suitable for providing breathing-quality air, provided the compressor suction is located in an uncontaminated atmosphere.

(k) *Personnel safety equipment -- (1) What additional personnel-safety equipment do I need?* You must ensure that your facility has:

(i) Portable H₂S detectors capable of detecting a 10 ppm concentration of H₂S in the air available for use by all personnel;

(ii) Retrieval ropes with safety harnesses to retrieve incapacitated personnel from contaminated areas;

(iii) Chalkboards and/or note pads for communication purposes located on the rig floor, shale-shaker area, the cement-pump rooms, well-bay areas, production processing equipment area, gas compressor area, and pipeline-pump area;

(iv) Bull horns and flashing lights; and

(v) At least three resuscitators on manned facilities, and a number equal to the personnel on board, not to exceed three, on normally unmanned facilities, complete with face masks, oxygen bottles, and spare oxygen bottles.

(2) *What are the requirements for ventilation equipment?* You must:

(i) Use only explosion-proof ventilation devices;

(ii) Install ventilation devices in areas where H₂S or SO₂ may accumulate; and

(iii) Provide movable ventilation devices in work areas. The movable ventilation devices must be multidirectional and capable of dispersing H₂S or SO₂ vapors away from working personnel.

(3) *What other personnel safety equipment do I need?* You must have the following equipment readily available on each facility:

(i) A first-aid kit of appropriate size and content for the number of personnel on the facility; and

(ii) At least one litter or an equivalent device.

(l) *Do I need to notify BSEE in the event of an H₂S release?* You must notify BSEE without delay in the event of a gas release which results in a 15-minute time weighted average atmospheric concentration of H₂S of 20 ppm or more anywhere on the facility.

(m) *Do I need to use special completion, completion and workover fluids or procedures?* When working in an area classified as H₂S present or H₂S unknown:

(1) You may use either water- or oil-base muds in accordance with § 250.300(b)(1).

(2) If you use water-base well-control fluids, and if ambient air sensors detect H₂S, you must immediately conduct either the Garrett-Gas-Train test or a comparable test for soluble sulfides to confirm the presence of H₂S.

(3) If the concentration detected by air sensors is over 20 ppm, personnel conducting the tests must don protective-breathing equipment conforming to paragraph (j)(13) of this section.

(4) You must maintain on the facility sufficient quantities of additives for the control of H₂S, well-control fluid pH, and corrosion equipment.

(i) *Scavengers.* You must have scavengers for control of H₂S available on the facility. When H₂S is detected, you must add scavengers as needed. You must suspend completion until the scavenger is circulated throughout the system.

(ii) *Control pH.* You must add additives for the control of pH to water-base well-control fluids in sufficient quantities to maintain pH of at least 10.0.

(iii) *Corrosion inhibitors.* You must add additives to the well-control fluid system as needed for the control of corrosion.

(5) You must degas well-control fluids containing H₂S at the optimum location for the particular facility. You must collect the gases removed and burn them in a closed flare system conforming to paragraph (q)(6) of this section.

(n) *What must I do in the event of a kick?* In the event of a kick, you must use one of the following alternatives to dispose of the well-influx fluids giving consideration to personnel safety, possible environmental damage, and possible facility well-equipment damage:

(1) Contain the well-fluid influx by shutting in the well and pumping the fluids back into the formation.

(2) Control the kick by using appropriate well-control techniques to prevent formation fracturing in an open hole within the pressure limits of the well equipment (drill pipe, work string, casing, wellhead, BOP system, and related equipment). The disposal of H₂S and other gases must be through pressurized or atmospheric mud-separator equipment depending on volume, pressure and concentration of H₂S. The equipment must be designed to recover well-control fluids and burn the gases separated from the well-control fluid. The well-control fluid must be treated to neutralize H₂S and restore and maintain the proper quality.

(o) *Well testing in a zone known to contain H₂S.* When testing a well in a zone with H₂S present, you must do all of the following:

(1) Before starting a well test, conduct safety meetings for all personnel who will be on the facility during the test. At the meetings, emphasize the use of protective-breathing equipment, first-aid procedures, and the

Contingency Plan. Only competent personnel who are trained and are knowledgeable of the hazardous effects of H₂S must be engaged in these tests.

(2) Perform well testing with the minimum number of personnel in the immediate vicinity of the rig floor and with the appropriate test equipment to safely and adequately perform the test. During the test, you must continuously monitor H₂S levels.

(3) Not burn produced gases except through a flare which meets the requirements of paragraph (q)(6) of this section. Before flaring gas containing H₂S, you must activate SO₂ monitoring equipment in accordance with paragraph (j)(11) of this section. If you detect SO₂ in excess of 2 ppm, you must implement the personnel protective measures in your H₂S Contingency Plan, required by paragraph (f)(13)(iv) of this section. You must also follow the requirements of § 250.1105. You must pipe gases from stored test fluids into the flare outlet and burn them.

(4) Use downhole test tools and wellhead equipment suitable for H₂S service.

(5) Use tubulars suitable for H₂S service. You must not use drill pipe for well testing without the prior approval of the District Supervisor. Water cushions must be thoroughly inhibited in order to prevent H₂S attack on metals. You must flush the test string fluid treated for this purpose after completion of the test.

(6) Use surface test units and related equipment that is designed for H₂S service.

(p) *Metallurgical properties of equipment.* When operating in a zone with H₂S present, you must use equipment that is constructed of materials with metallurgical properties that resist or prevent sulfide stress cracking (also known as hydrogen embrittlement, stress corrosion cracking, or H₂S embrittlement), chloride-stress cracking, hydrogen-induced cracking, and other failure modes. You must do all of the following:

(1) Use tubulars and other equipment, casing, tubing, drill pipe, couplings, flanges, and related equipment that is designed for H₂S service.

(2) Use BOP system components, wellhead, pressure-control equipment, and related equipment exposed to H₂S-bearing fluids in conformance with current NACE Standard.

(3) Use temporary downhole well-security devices such as retrievable packers and bridge plugs that are designed for H₂S service.

(4) When producing in zones bearing H₂S, use equipment constructed of materials capable of resisting or preventing sulfide stress cracking.

(5) Keep the use of welding to a minimum during the installation or modification of a production facility. Welding must be done in a manner that ensures resistance to sulfide stress cracking.

(q) *General requirements when operating in an H₂S zone -- (1) Coring operations.* When you conduct coring operations in H₂S-bearing zones, all personnel in the working area must wear protective-breathing equipment at least 10 stands in advance of retrieving the core barrel. Cores to be transported must be sealed and marked for the presence of H₂S.

(2) *Logging operations.* You must treat and condition well-control fluid in use for logging operations to minimize the effects of H₂S on the logging equipment.

(3) *Stripping operations.* Personnel must monitor displaced well-control fluid returns and wear protective-breathing equipment in the working area when the atmospheric concentration of H₂S reaches 20 ppm or if the well is under pressure.

(4) *Gas-cut well-control fluid or well kick from H₂S-bearing zone.* If you decide to circulate out a kick, personnel in the working area during bottoms-up and extended-kill operations must wear protective-breathing equipment.

(5) *Drill- and workover-string design and precautions.* Drill- and workover-strings must be designed consistent with the anticipated depth, conditions of the hole, and reservoir environment to be encountered. You must minimize exposure of the drill- or workover-string to high stresses as much as practical and consistent with well conditions. Proper handling techniques must be taken to minimize notching and stress concentrations. Precautions must be taken to minimize stresses caused by doglegs, improper stiffness ratios, improper torque, whip, abrasive wear on tool joints, and joint imbalance.

(6) *Flare system.* The flare outlet must be of a diameter that allows easy nonrestricted flow of gas. You must locate flare line outlets on the downside of the facility and as far from the facility as is feasible, taking into account the prevailing wind directions, the wake effects caused by the facility and adjacent structure(s), and the height of all such facilities and structures. You must equip the flare outlet with an automatic ignition system including a pilot-light gas source or an equivalent system. You must have alternate methods for igniting the flare. You must pipe to the flare system used for H₂S all vents from production process equipment, tanks, relief valves, burst plates, and similar devices.

(7) *Corrosion mitigation.* You must use effective means of monitoring and controlling corrosion caused by acid gases (H₂S and CO₂) in both the downhole and surface portions of a production system. You must take specific corrosion monitoring and mitigating measures in areas of unusually severe corrosion where accumulation of water and/or higher concentration of H₂S exists.

(8) *Wireline lubricators.* Lubricators which may be exposed to fluids containing H₂S must be of H₂S-resistant materials.

(9) *Fuel and/or instrument gas.* You must not use gas containing H₂S for instrument gas. You must not use gas containing H₂S for fuel gas without the prior approval of the District Supervisor.

(10) *Sensing lines and devices.* Metals used for sensing line and safety-control devices which are necessarily exposed to H₂S-bearing fluids must be constructed of H₂S-corrosion resistant materials or coated so as to resist H₂S corrosion.

(11) *Elastomer seals.* You must use H₂S-resistant materials for all seals which may be exposed to fluids containing H₂S.

(12) *Water disposal.* If you dispose of produced water by means other than subsurface injection, you must submit to the District Supervisor an analysis of the anticipated H₂S content of the water at the final treatment vessel and at the discharge point. The District Supervisor may require that the water be treated for removal of H₂S. The District Supervisor may require the submittal of an updated analysis if the water disposal rate or the potential H₂S content increases.

(13) *Deck drains.* You must equip open deck drains with traps or similar devices to prevent the escape of H₂S gas into the atmosphere.

(14) *Sealed voids*. You must take precautions to eliminate sealed spaces in piping designs (e.g., slip-on flanges, reinforcing pads) which can be invaded by atomic hydrogen when H₂S is present.

[62 FR 3795, Jan. 27, 1997. Redesignated and amended at 63 FR 29479, 29485, May 29, 1998; 65 FR 15864, Mar. 24, 2000. Redesignated and amended at 68 FR 8423, 8434, Feb. 20, 2003]