

DISCUSSION
OF
RULE 36 REQUIREMENTS

TESTING PROCEDURES

Section (c)(1)

What must you do to comply with the testing portion of Rule 36? Points to consider: (1) Where to sample; (2) Acceptable test instruments; (3) How to sample; and (4) Shortcut.

WHERE TO SAMPLE

You, as an operator, need to know the Hydrogen Sulfide concentration and volume at any given point in your system. A typical well has two sample points, the tubing and the casing. **The tubing is the preferred sampling point** if there is free gas available. If there is no free gas, a second choice would be to hook up a portable test unit at the well and sample the gas as it is separated. A third choice would be to test the well as you do for the W-10 or G-10 tests, and sample the gas at the end of the test period.

The casing represents an easy sample point in a well without a packer because there is normally free gas available. However, this may not be a valid concentration for flow-line calculations because the casing can behave similarly to a storage tank and concentrations can vary. The casing can be a good sample point, if little or no gas is produced through the tubing and the casing produces gas continuously.

After each well is tested, the concentration in each flow line can be calculated. Be sure to recalculate at any point where flow lines are joined. The separator or heater treater affords an excellent cross-check on flow-line calculations. Each storage tank should be measured when the tank is at least three-quarters full.

ACCEPTABLE TEST INSTRUMENTS

"Acceptable test instruments" is the second point. All tests should be field tests, as Hydrogen Sulfide will impregnate all known sample containers: Glass, Plastic, Stainless Steel, etc.

Colorimetric Tubes are approved for storage tanks only. Use only industry accepted tubes.

The testing instructions vary somewhat for various tubes and are provided with each box of test tubes. However, since these tubes are not to be force-fed, it is a good idea to run the gas supply into an open jar or bottle, and pull the sample from the bottle at atmospheric pressure. The colormetric tubes are not acceptable for radius of exposure calculations.

Section (c)(1)(A) of Statewide Rule 36 references ASTM and GPA publications for approved test instruments. These publications indicate **two approved testing techniques: Cadmium Sulfate Absorption and Tutweiler**. There is also a provision to approve other instruments. However, at this time, no other instruments have been approved by the Commission.

The **Cadmium Sulfate Absorption** technique has the capability to distinguish Hydrogen Sulfide from the other sulfur compounds. The absorption technique is only applicable to six grains or 99 parts per million (PPM), which limits its use to borderline testing.

The **Tutweiler** and **Colormetric Tubes** measure total sulfur.

The Tutweiler is the preferred method with greatest flexibility.

HOW TO SAMPLE

The storage tanks should be sampled while three-fourths or more full with a hand pump and enough gum rubber tubing to sample one foot above the fluid level. Care should be taken to purge the sampling apparatus of all air. The concentration can then be determined with the Tutweiler, Cadmium Sulfate Absorption or Colormetric Tubes.

For all other sampling points, the first step is to locate an access to free gas. A needle valve, or other means of controlling rate and volume, and length of gum rubber tubing should be attached. Again, the sampling system must be purged of all air. Sample while maintaining a constant flow. Determine the concentration with the Tutweiler or Cadmium Sulfate Absorption technique.

A brief comment about safety. If the range of concentrations is unknown or suspected to be high, a closed-breathing system should be used while sampling. At the very least, use the buddy system with life lines.

SHORTCUT

The last topic is the "Shortcut". Assuming that you have a large system with many wells in one area, and you do not wish to test each well, you may spot check to determine the highest concentration in the system and use this highest concentration in all radii of exposure calculations for the entire system. This shortcut is a trade-off with fewer field measurements, but a larger radius of exposure is used for the entire system.

RADIUS OF EXPOSURE

Section (c)(2) of Rule 36 states "For all operations subject to this rule, the radius of exposure shall be determined, except in the cases of storage tanks, by the following Pasquill-Gifford equations, or by other methods that have been approved by the Commission". The radius of exposure, as we are defining it in Statewide Rule 36, is that distance surrounding a possible or potential leak site where the concentration of 100 parts per million or 500 parts per million (depending on which radius is being calculated) will remain at a constant level for a 24-hour period by way of a continuous emission. The radius of exposure shall be determined for all facilities, other than storage tanks, that have a concentration of 100 parts per million or greater.

The methods discussed here that can be used to determine a radius of exposure are the Pasquill-Gifford equation and the Nomograph (For Nomographs, see last two pages of this book). It should be pointed out that currently these are the only approved methods by which the radius of exposure can be determined. The Pasquill-Gifford equation can be found under Section (c)(2)(A) of the rule. The first equation is for 100 parts per million and the second equation is for the 500 parts per million equation, a 400 parts per million concentration can be entered in the equation and an answer will come out. Naturally, it will be meaningless if you do not have 500 parts to begin with. The equation Pasquill originally formulated was in metric terms, so we have converted this from metric terms to oil-field terms. The "Q" in the equation is the escape rate for a system or facility expressed in cubic feet per day. The "Q" for a gas well will either be the well's adjusted open-flow potential, or if you feel this is too high, your estimate of the well's capacity to flow against a zero back-pressure. The Mole Fraction of Hydrogen Sulfide used in the equation, is the cubic feet of Hydrogen Sulfide per 100 standard cubic feet of mixture expressed as a percent. The Hydrogen Sulfide concentration will have to be converted to a Mole Fraction if expressed in parts per million or grains. "X" is the radius of exposure expressed in feet.

As originally formulated, the Pasquill-Gifford equation described the plume in a three-plane coordinate system. The "X" axis is that direction in which the wind would be blowing at a continuous rate. The "Y" and "Z" axis will be vertical and perpendicular. It is assumed that the emission will be constant to the point that some distance downstream of this is a point at which the 100 parts per million concentration will remain constant over a 24-hour period. Regarding the "Y" and "Z" planes, it is assumed that there is a normal Gaussian distribution; that is there is less concentration on the sides, with the highest concentration in the center. In order to simplify this equation, it is assumed that the point of emission will be at or near the ground level. The reason for this is that most of your wells and part of your facilities are rather close to the ground. It also eliminates that very complex exponent of this equation that is used for effective stack height. The Environmental Protection Agency and the Texas Natural Resources Conversation Commission use this equation.

The original equation took into account meteorological parameters. These are classed into categories A, B, C, D, E and F. Class "A" would be your most unstable; that is, higher velocity winds, more radiation, unlevel terrain, etc. Class "F" is the most stable condition. The Railroad Commission has used this Class "F" condition as it will present the most conservative of your parameters. To further simplify the equation, a wind velocity of one mile per hour is assumed since this situation presents the lease amount of fresh-air mixing. consequently, this gives the largest radius of exposure.

Thus we have the following assumptions in this equation:

- (1) Maximum escape rate (complete separation or rupture)
- (2) Stability Class "F" meteorological parameters (there is stability throughout the diffusing layers).
- (3) A wind velocity of one mile per hour.
- (4) The point of emission is at or near the ground level.
- (5) A normal Gaussian distribution of both "Y" and "Z" Planes.

- (6) A constant wind direction.
- (7) Relative level terrain (minimum ground mixing).

It should be pointed out that in calculating a radius of exposure, you should take into account the terrain around the point of emission or possible emission. If there is a cliff a short distance from your well, the probability of the Hydrogen Sulfide going up this is quite small. However, if there is a small creek bed or a small valley like we have in East Texas, with pine trees on both sides; the gas will collect under these trees or in this valley and remain longer. The terrain should be considered when calculating a radius of exposure. The equation is not accurate to the degree that if you calculated a radius of exposure of 1,500 feet, gas is not going to get beyond it. there is a possibility it may.

These three methods provide the best estimate for concentration of a gas at a given distance from a point of emission; however, these predictions are not infallible. The field data collected to date, based on a 10-minute sampling time, indicates that for ground level concentrations, you have a safety factor of two to three. Thus, the radius of exposure calculations, as presented in this rule, is based on the worst possible conditions to create the maximum radius of exposure. A radius of exposure can be calculated using the equation as set out in this rule or by using the Nomographs.

The 100 and 500 parts per million Nomographs. To use these Nomographs, enter the left side with your concentration of Hydrogen Sulfide. This must be expressed in either parts per million or percentage. then draw a straight line across the page to the "Q" rate. For a facility or oil lease, use the escape rate; for a gas well, use the flow against a zero back-pressure. The radius of exposure is the point on the center bar crossed by the line. Again, these Nomographs are based on the assumption previously listed.

These methods of determining a radius of exposure provide the following:

- (1) All operators will use a uniform calculation method.
- (2) It will assure that an approved, conservative equation and compatible parameters have been used in determine the radius of exposure.

- (3) This will assist the Railroad Commission personnel when determining the compliance status of a field facility that is being reviewed for certification.
- (4) The radius of exposure, as determined by these methods, is used as the criteria to require certain actions under this rule.

Section (c)(3) of Rule 36 deals with four possible field conditions. Section (c)(3)(A) of the rule indicates that the escape rate is "The maximum daily volume rate of gas containing Hydrogen Sulfide handled by that system element for which the radius of exposure is calculated". This refers to all facilities except the gas well itself. thus, the "Q" rate (the maximum escape rate at the plant or the facility) would be used in calculating the radius of exposure. Section (c)(3)(B) covers the current existing well that is in a recognized field. For the calculation of the radius of exposure, the "Q" rate will either be the open-flow potential, the adjusted open-flow potential or an estimated escape rate. If an estimated rate is used, a justification for the use of a lower "Q" instead of the adjusted open-flow potential should be given. Section (c)(3)(C) is for drilling of new wells in known areas, where there is sufficient data to know both the concentration and the expected volume rates. The rates used will be the adjusted open-flow rates of the offset wells or the field average current adjusted open-flow rate, whichever is larger. Section (c)(3)(D) states that all escape rate calculations will be based on standard conditions of 14.65 psia and 60° Fahrenheit.

Section (c)(4) of this rule covers new wells drilled as wildcats, or wells drilled in an area where there is insufficient data to calculate a radius of exposure, but where a formation containing Hydrogen Sulfide is anticipated. In this situation, a 100 parts per million radius of exposure, equal to 3,000 feet, will be assumed. If a lesser radius can be justified, a written request must be submitted to the Commission asking for an exception.

STOCK TANK PROVISION

Section (c)(5) of Rule 36 deals with storage tanks. Storage tanks which are utilized as a part of a production operation, and which have a Hydrogen Sulfide concentration in excess of 500 parts per million, shall be subject to the rule. This does not include pipeline storage tanks. Section (c)(5)(A) of the rule states that storage tanks do not require a calculation of a radius of exposure. Section (c)(5)(B) requires a warning sign to be posted on or within 50 feet of the facility indicating a potential danger. Section (c)(5)(C) requires fencing as a securing measure when the tank is located within city limits or a township, or where conditions cause the storage tanks to be exposed to the public. It is up to the operator to determine if the tank will be exposed to the general public. Sections (c)(5)(D) and (c)(5)(E) place storage tanks under the Warning and Marker Provision (Section (c)(6)(a)) and the Certificate of Compliance Provision (Section (d)(1)).

Although not stated in the rule, it is required that the storage tank be at least three-quarters full of crude of oil when tested for Hydrogen Sulfide concentration, and that the measurement be taken approximately one foot above this surface.

WARNING AND MARKER SECURITY

The signs and fencing requirements of Rule 36 are found under Section (c)(6)(A) and Section (c)(6)(B). For facilities that have a 100 parts per million radius of exposure that is in excess of 50 feet, there must be signs at the facility and on all access roads. The sign must say "**CAUTION**" and "**POISON GAS**", and it must comply with the standards as indicated in the rule. This standard specifies the coloring on the sign to be **black** and **yellow**, and the size of the lettering to be large enough to be readable from a reasonable distance. The unattended facilities must also be fenced and locked if it is within the city limits or within a quarter-mile of a dwelling, place of business, hospital, church, school, government building, school bus stop, public park, city, town, village or similarly populated area.

Specific fencing requirements will be satisfied on a case-by-case basis as determined by the appropriate district office.

During drilling or workover operations, it is recommended that operational flags be displayed at the lease entrance depicting the status of any danger associated with hydrogen sulfide.

MATERIALS AND EQUIPMENT

Materials and Equipment are covered under Section (c)(6)(C) of Rule 36. Due to the complexity of the provision, the purpose of this discussion is not to address the design of specific equipment, but rather to attempt to expand on the intent of the provision.

First of all, this provision is to apply only to those elements of the system that contribute to the contamination or the safety control of the system.

The intent of this section of the rule, and specifically the portion covering drilling and workover operations, is to extend the metal standards only to those elements of the system where gas is intentionally contacted to the metal components of the system. Section (c)(6)(C)(i) states in part that "For new construction or modification of facilities (including materials and equipment to be used in drilling and workover operations) completed or contemplated subsequent to the effective date of this rule, the metal components shall be those metals which have been selected and manufactured so as to be resistant to Hydrogen Sulfide stress cracking under the operating conditions for which their use is intended, provided that they satisfy requirements described in the latest editions of NACE Standard MR-01-75 and API RP-14E, Sections 1.7(C), 2.1(C), 4.7".

As you know, sulfide stress cracking is a result of metals being subjected to high stress levels in a corrosive environment where Hydrogen Sulfide is present. The metal will often fail catastrophically in a brittle manner. This phenomenon is a function of metal chemical composition and hardness, heat treatment and microstructure, as well as factors such as pH, Hydrogen Sulfide concentration, stress and temperature. It is also a function of handling of the material. The Railroad Commission has adopted the above mentioned NACE publication, as it provides sufficient latitude in material selection in order to limit the sulfide stress cracking phenomenon.

Furthermore, this section of the rule states "The handling and installation of materials and equipment used in Hydrogen Sulfide service is to be performed in such a manner so as not to induce

susceptibility to sulfide stress cracking". This means to avoid cold work stresses. For example, a piece of equipment or material that satisfies the accepted standard, can be made susceptible to sulfide stress cracking by several means, such as transport, loading, unloading, hammer marks, stress risers, improper welding procedures, excessive torque while making up pipe (box ends are susceptible to work hardening of mating surfaces) and cold stress by excessive loads, etc.

Other materials which are non-susceptible to sulfide stress cracking, such as fiberglass and plastics, may be used in Hydrogen Sulfide service provided that such materials have been manufactured and inspected in a manner which will satisfy the latest published and applicable industry standard specification or recommended practices.

Section (c)(6)(C)(ii) of the rule states that "Other materials and equipment (including materials and equipment used in drilling and workover operations) which are not included within the provision of Section (c)(6)(C)(i) above, may be used for Hydrogen Sulfide services provided":

- (1) "Such materials and equipment are proved, as the result of advancements in technology or as the result of control and knowledge of operating conditions (such as temperature and moisture content), to be suitable for the use intended, and where such usage is technologically acceptable as good engineering practice."
- (2) "The Commission has approved the use of said materials and equipment for the specific uses after written application."

In essence, this section is a "catch all" provision. However, NACE does not allow the use of susceptible materials in situations by controlling the environment. Nor does this rule allow the use of materials and equipment that are known to be susceptible to stress cracking solely by attempts to control moisture content or temperature.

Section (c)(6)(C)(iii) states that "Existing facilities (including materials in present common usage for drilling and workover operations in Hydrogen Sulfide areas) which are in operation prior to the effective date of this rule, and where there has been no failure of existing requirements of this rule".

This section is the "**grandfather**" clause. In essence, this means that equipment currently in use within the confines of a field can continue to be used in that field, and it also can be interchanged under similar conditions provided no failures have occurred. This section also applies to the use of drill pipe, drill collars, blowout preventers, choke manifolds and fittings; since these materials are being used primarily for the control of the well; and where they are not intentionally used to contain gases of high Hydrogen Sulfide concentrations.

Section (c)(6)(C)(iv) states that "in the event of a failure of any element of an existing system as the result of Hydrogen Sulfide stress cracking, the compliance status of the system shall be determined by the Commission after the operator has submitted to the Commission a detailed written report on the failure". According to this provision, not only the component part, but the entire system shall be examined if it or any part fails to satisfy the requirement described in the current acceptable NACE and API standards.

CONTROL AND SAFETY PROVISION

Section (c)(8), covers the control and safety provision of Rule 36. This provision states "Operators subject to this provision shall install safety devices and maintain them in an operable condition or shall establish safety procedures designed to prevent the undetected, continuing escape of Hydrogen Sulfide".

The rule states that if you have a 100 parts per million radius of exposure in excess of 50 feet, and it penetrates a public area, or if it is equal to or greater than 3,000 feet, you will have automatic devices that will detect a leak or you will have safety procedures in place to adequately detect a leak. In that the rule does not specify the type of equipment or the number required, operators should comply with the intent of the rule to prevent the undetected, continuing escape of Hydrogen Sulfide, whether it be by the use of safety control, monitors, or safety procedures. The Commission must evaluate each system for compliance.

At this time, if you have a question on compliance, it is suggested that the Railroad Commission district office be contacted. Should a satisfactory solution fail to be reached at that level, then it is suggested that an appeal be made to the Austin office, and if necessary, the case may be set for public hearing.

CONTINGENCY PLANS

The requirement for a contingency plan and its contents is covered in Section (c)(9) of Rule 36. The purpose of the plan is to provide an organized plan of action for alerting and protecting the public following an accidental release of a potential hazardous volume of Hydrogen Sulfide. The plan is not a check list of equipment and players but a game plan; a plan of action, a logical step-by-step approach to an emergency. The plan will also help to prevent overreaction and the bringing in of unnecessary people when the operator may have the capability to handle the problem. As defined in Section (c)(7) of the rule, whenever the radius of exposure includes a public area or is equal to or exceeds 3,000 feet, a contingency plan is required.

Some of the things a plan should include are listed below. The list is not in order of importance, and some items may not apply to every plan, but a plan may include the following:

1. Instructions for alerting employees and the public in case of an emergency.
2. Procedure for requesting assistance and follow-up action to remove the public from the area of exposure.
3. A call list of people to notify of an emergency. For example:

INTERNAL LIST

| <u>Title</u> | <u>Name</u> | <u>Office Phone</u> | <u>Home Phone</u> |
|------------------|-------------|---------------------|-------------------|
| Production Supt. | | | |
| Drilling Supt. | | | |
| Field Engineer | | | |
| Lease Operator | | | |

EXTERNAL LIST

| | |
|-----------------------------|--|
| Ambulance | Police or Fire Department |
| Hospital | Railroad Commission |
| Doctor | Texas Natural Conservation Commission |
| Department of Public Safety | Contractors and Service Companies (Include name and type of equipment available) |

4. Plat of area showing radius of exposure, location of public areas, location of evacuation

routes, location of safety equipment and telephones.

5. List of names and telephone numbers of residents within the area of exposure and the person responsible for any public area.
6. Provision for advance briefing of public within an area of exposure. This briefing should include information on the hazards and characteristic of Hydrogen Sulfide, possible sources, instructions for reporting a leak and the manner in which the public will be notified of an emergency. If several operators have leases with overlapping radii, this briefing should be coordinated so there will not be a lot of duplication and unnecessary contacts.
7. Detailed operating procedures to be followed in an emergency including specific job assignments for personnel.
8. Detailed remedial procedures to be followed in an emergency.
9. Rules for when protective equipment such as clothing, fresh air breathing equipment, gas detectors, etc. is required to be used by personnel.
10. A plan should include conditions of weather, differences in terrain and covering vegetation and seasonal changes that might create an increase in hazardous conditions or an abnormal dispersion pattern.

In the event of a high density of population, or where the population density is unpredictable, a **reaction plan** will be acceptable in lieu of a contingency plan. The main differences between a contingency plan and a reaction plan is that the reaction plan does not require the advance briefing of the public nor the listing of names and phone numbers. This plan must be approved by the Railroad Commission prior to implementation.

Any plan should be kept close to where the action might be and readily available to operating personnel. The plan should be short, simple and as workable as possible, so that the man in the field can

understand it and can quickly find the portion needed in case of an emergency. A working knowledge of the

plan by all personnel is desirable. Information on the plan should be included with safety training programs.

Any plan, no matter how well conceived, will need to be updated from time-to-time. Periodic reviews should be made to keep all portions of the plan current, especially the call list.

INJECTION PROVISION

The injection of a fluid containing Hydrogen Sulfide is covered in Section (c)(10) of the rule. As defined in Section (c)(10), injection of Hydrogen Sulfide is not allowed if the 100 ppm radius of exposure exceeds 50 feet and includes any part of a public area; or, if the 100 ppm radius of exposure is 3,000 feet or greater, unless first approved by the Commission after a public hearing. If the injection project falls into one of the above categories, a public hearing must be requested. The radius of exposure is calculated on the concentration of Hydrogen Sulfide and volume to be used for injection. The injection well's capability to flow to the atmosphere against zero pressure should be considered in calculating the radius of exposure. This section of the rule applies to existing projects and to gas lift operations. A project using gas which has had the Hydrogen Sulfide content increased by a processing plant will also require a hearing.

Operations subject to this provision are required to notify all offset operators. If the radius of exposure includes a public road, local law enforcement agencies should be notified. Notification to all residents and businesses within the 100 ppm radius of exposure is also required. The published notice as required for SWR 9 or 46 must include notice of H₂S injection and state that a public hearing will be required.

An injection project not covered in the above criteria will not require a public hearing, but it will still be subject to any part of Rule 36 that may be applicable.

SECTION (c)(11)
For
DRILLING, WORKOVER AND GASOLINE PLANTS

Section (c)(11) sets out special provisions for drilling and workover operations, and gasoline plant sites where the 100 ppm radius of exposure is greater than 50 feet. These special provisions are in addition to any proceeding requirements of Rule 36. These special provisions are:

- A. Protective breathing equipment shall be maintained in two or more locations at the site. The two locations should be selected so that at least one unit will be accessible, regardless of the wind direction.
- B. Wind direction indicators shall be installed at strategic locations at or near the site and be readily visible from the site. The number required will depend upon the site. One wind indicator would be sufficient if it is readily visible from any location on a site. Where wind indicators are needed at night, they must be illuminated.
- C. Automatic Hydrogen Sulfide detection and alarm equipment that will warn of the presence of Hydrogen Sulfide gas in concentrations that could be harmful shall be utilized at the site.

Please do not confuse the provisions of this section with the drilling and workover provisions of Section (c)(12). Section (c)(12) deals with the provisions of drilling and workover operations where the 100 ppm radius of exposure includes a public area or is greater than 3,000 feet. The provisions of (c)(12) are in addition and more specific than the provisions of Section (c)(11).

DRILLING PROVISION

The drilling provision of Rule 36 is found in Section (c)(12). This provision is directed toward any drilling and workover operation where the 100 parts per million radius of exposure is greater than 50 feet and includes a public area or is 3,000 feet or greater. A workover in this situation is the removal of the christmas tree or the movement of tubing. Changing out a valve, other than the master valve, is not considered a workover.

Section (c)(12)(A) states, "Protective breathing equipment shall be maintained at the well site". It is suggested that the number and type of protective breathing equipment should be determined by the operator, based on the maximum number of persons constantly at the well site. The acceptable type of breathing equipment is the pressure demand fresh air breathing type. The breathing equipment should be maintained at strategic points throughout the drilling location, and they should be checked daily.

Section (c)(12)(B) states, "The operator shall provide a method of igniting the gas in the event of an uncontrollable emergency". This can be accomplished either by flare guns or other acceptable methods.

Section (c)(12)(C) states, "The operator shall install a choke manifold, mud-gas separator and flare line and provide a suitable method for lighting the flare". The choke manifold does not have to necessarily be Hydrogen Sulfide trimmed, as previously mentioned in the Materials and Equipment Provision. The mud-gas separator should be located between the first and second mud tanks. It should be baffle-type construction (not pressurized). Flare lines from the mud-gas separator should be parallel to and perpendicular to prevailing wind direction, and should be maintained in a manner that should be unrestricted to flow. For igniting flare gas at the burn pit or flare line, either a flare gun or an automatic ignition system (including a source of pilot gas) should be available. Railroad Commission Districts 5 and 6 require flare stacks.

Section (c)(12)(D) states, "secondary remote control of blowout prevention and choke equipment is to be located away from the rig floor at a safe distance from the wellhead". Safe distance, in this instance, is to be left up to the discretion of the operator or contractor.

Section (c)(12)(E) states "drill-stem testing of Hydrogen Sulfide zones is permitted only in daylight hours". The operator will be permitted to conduct a full drill-stem test only if the drill stem meets metallurgical requirements of NACE. If the drill stem is not of acceptable standards, then a work string satisfying the NACE standard must be used. If the work string does not meet the standards, then the drill-stem test will have to be limited to the use of a downhole sampling device.

Sections (c)(12)(F), (G), (H), (I) and (J) appear to be self-explanatory, and will not be discussed.

Please be aware that the requirements of the drilling provisions are in addition to any other requirements of the proceeding sections.

TRAINING REQUIREMENT PROVISION

The training requirement of Rule 36 is covered in **Section (c)(13)**. The intent in this provision is to insure that the personnel are trained to prevent and react to an emergency to the degree that safety will be ensured.

Section (c)(13)(A) states that "Each operator whose operations contain H₂S in excess of 100 parts per million shall train its employees working in the affected area.

Section (c)(13)(B) requires that service company personnel also be trained if the work they are performing at well sites, gasoline plants or pipelines could allow the escape of H₂S gas. This provision, therefore would not apply to personnel delivering equipment, painting tanks, hauling pipe, etc.

Section (c)(13)(C) states "The training of personnel shall include the following elements":

- (i) **Hazards and Characteristics of Hydrogen Sulfide.** - In training personnel, it is suggested that each individual be instructed as to the toxic effects of Hydrogen Sulfide and the physical effects at various levels of Hydrogen Sulfide exposure.
- (ii) **Safety Precautions** - Safety precautions normally vary depending on the nature of the situation. The surrounding working conditions and environment would dictate what specific precaution should be observed. In general, when working in a Hydrogen Sulfide environment, individuals should be aware of the Hydrogen Sulfide concentration present, they should not work alone in contaminated areas (make use of the "buddy system") and they should be observant of the wind direction at all times.
- (iii) **Operation of safety equipment and life-support system.** - All personnel should be able to operate safety and life-support systems, including fresh-air breathing equipment and resuscitation equipment. Routine drills on the use of this equipment should be conducted at frequent intervals.

Section (c)(13)(D) specifies that supervisory personnel shall be additionally trained in the following:

- (i) Effect of Hydrogen Sulfide on metal components in the system.
- (ii) Corrective action and shut-down procedures, and when drilling a well, blowout prevention and well control procedures.
- (iii) Full knowledge of the requirement of the contingency plan, when such plan is required.

For this section, supervisory personnel would be the persons in charge of the operation at a particular time. Such a person must be on site at all times if the operation has a public area in the 100 parts per million radius of exposure or if the radius of exposure is greater than 3,000 feet.

NOTIFICATION REQUIREMENT

This section requires that the appropriate Commission district office be immediately notified of any accidental release of Hydrogen Sulfide gas of sufficient volume to present a hazard, and of any Hydrogen Sulfide related accident, whether the injured party is an employee or a member of the general public. As defined in Definitions of SWR 36 (b)(10)(A)(B)&(C), a potentially hazardous volume of hydrogen sulfide is a volume of hydrogen sulfide gas of such concentration that (1) the 100 ppm radius of exposure is in excess of 50 feet and includes any part of a “public area” except a public road; (2) the 500 ppm radius of exposure is greater than 50 feet and includes any part of a “public road”; (3) the 100 ppm radius of exposure is greater than 3,000 feet. In addition, 12 hours advance notification of an intentional release, or as soon as possible after an unplanned intentional release in an emergency situation, is required should the contingency plan be activated.

These notifications must be followed by a written report to the appropriate district office within 10 days of the incident.