TEXAS RAILROAD COMMISSION RULE 36 IN OIL PRODUCTION

PHILIP W. BLAKE
Safety Consulting, Inc.

ABSTRACT

Rule 36 of the Texas Railroad Commission is rapidly being recognized as one of the most, perhaps the *most significant safety regulation of the post-OSHA era. Until the initial publication of Rule 36 in 1975 the many hazards of H_2S were only vaguely understood and no regulation for positive control of the gas existed. It covers drilling operations as well as production and provides that every operator have written operating and training plans to protect both employees and the general public from uncontrolled gas leakage. It provides a workable mathematical formula for computing gas dispersion. Since its final issue in 1976, Rule 36 has become a model for similar state oil and gas regulations in numerous states and was one of the principal sources of data for the proposed safety standard recommended by NIOSH. Its scope and thoroughness make it a landmark.*

Rule 36 of the Oil and Gas Division of the Texas Railroad Commission has been something of a marvel to many observers.[1] As a practitioner of oil field safety, I am not unfamiliar with the typical government process of issuing incomprehensible regulations which demand controls totally beyond the capability of the regulated. Such attempts to regulate usually result in a great deal of animosity, and vast amounts of energy and ingenuity are absorbed in devising means of circumventing the rules. In my observations, there appears to have been little of that kind of activity with Rule 36.

Why? It is significant to note that the original Rule 36 was a product, not of a panel of researchers from their ivory towers, but of a group of oil industry representatives. In fact, it was an industry association, Texas Mid-Continent Oil and Gas Association, which submitted the first proposed regulation. That proposal was offered at a hearing in Kilgore, Texas on February 28, 1973. It is also significant that the Commission's first issuance of an H_2S control regulation—Special Order 2-62,673—was very close to the Mid-Continent Oil and Gas Association proposal. That order was issued on September 25, 1973. It was an excellent first effort which was mostly self-regulatory in nature. No prior submissions to or approval by the Commission were specified.

The original Rule 36 set a baseline of 20 ppm of H_2S in air for applicability. It required that all operators rig for H_2S to provide adequate protection to both oil field workers and to the general public. OSHA, the Occupational Safety and Health Administration, and EPA, the Environmental Protection Agency, already addressed the problems of worker and public protection, respectively, in general terms, but neither did it in the specific manner necessary to make field level enforcement practical. Neither did those federal agencies possess the personnel, the equipment, nor the expertise to accomplish that enforcement job.

The initial version of Rule 36 covered oil well drilling and workover operations as well as producers. It required that all operators of such installations post appropriate warning signs, use equipment and materials specifically designed for an H_2S environment, and that they have an emergency contingency plan. Commission officers were authorized to enter drilling and production sites to determine compliance with the Rule. It is probably accurate to say that, among those operators who had "got the word," there was beginning to be fair compliance by early 1975. In East Texas where the Smackover formation was known to yield up to 90% H_2S in deeper holes, there was relatively good compliance. In South Central Texas, where the Edwards

could yield up to 2%, there was perhaps less concern. And in West Texas where very low concentrations seemed to be common, there appeared to this observer to be still less concern.

It was inevitable, then, for the industry and the Commission to be jolted into the next phase of action by a tragedy in West Texas. On February 1, 1975, nearly two years after the initial hearing, an undetected gas escape at Denver City, Texas, resulted in the deaths of nine persons. This resulted in a Commission hearing which was called on March 13, 1975 to consider strengthening Statewide Rule 36. As in previous instances, the oil industry responded strongly to the need. Texas Mid-Continent Oil and Gas Association presented four major revisions to the Rule: (1) expand its applicability to specifically cover a broader base of operational functions, (2) require advance submission of Emergency Contingency Plans to the Commission, (3) raise the lower limit of applicability of the rule from 20 ppm to 100 ppm, and (4) require that all facilities where an H_2S hazard exists near populated areas be fenced and locked.

Subsequently, the Commission, after a great deal of research by its staff, issued on April 17, 1975 the first revision of Rule 36. It was more specific than the original and was heavily performance-oriented in that it required that each operator file a Certificate of Compliance, Form H-9, with the Commission before start-up of operations. It also required that the operator notify the Commission immediately in the event of a leakage of gas containing H_2S in concentrations exceeding 100 ppm. API-RP-49, the excellent publication of the American Petroleum Institute, was used as the source for a recommendation of format for an emergency contingency plan.[2] The Commission also required a "reasonable" radius of exposure for a potential danger zone and specified that any fixed surface facility within one-quarter of a mile of a populated public area be fenced and locked.

Almost as soon as this version was released, the Commission was besieged by requests from operators demanding that the generalities of the Rule be made more specific. After all, a Certificate of Compliance was required which stated unequivocally that the Operator *was* in compliance. The question, ". . . with exactly what conditions?" had to be answered more clearly. For this reason the April version of Rule 36 was never actually placed in effect. Instead, another hearing was held on September 3, 1975 and the Commission and industry representatives were well on their way to developing Rule 36 in its present form. The current version was issued March 15, 1976 and became effective September 1, 1976. Many of the requirements of the first revision which were judgmental in nature began to take on specific form in the current version.

For example, the "reasonable" radius of exposure became specifically measurable by the application of a formula derived from the Pasquill-Gifford equation. The Commission also recognized that drilling must also occur in areas where there would be insufficient data to calculate a radius of exposure. In those cases they directed that a 100 ppm radius of exposure of 3,000 ft be assumed.

A concentration of 100 ppm became the boundary between operations covered by the Rule and those not covered. This decision was based upon a detailed consideration of the toxicity of H_2S at its various concentrations. Since there are detectable effects of H_2S at 100 ppm but death is not likely, 100 ppm seemed to be a logical dividing line. This in no way endorses working in that or lower concentrations of H_2S; it merely states that Rule 36 comes in only at that limit. OSHA requirements currently (at this writing) permit no exposure greater than 50 ppm for thirty minutes, and ceiling concentrations for working conditions are 20 ppm. No Threshold Limit Value (TLV) is defined by either set of regulations.

The phenomenon of "Hydrogen Embrittlement" of metals has been recognized for many years. The science of metallurgy has made significant advances in its knowledge of the effect of the so-called "sulfide stress cracking" of various alloys. The Texas Railroad Commission in its 1975 deliberations simply specified that all materials used in an H_2S environment would meet requirements of NACE standard MR-01-75 and API-RP-14E, Sections 1.7(c), 2.1(c), 4.7. They did not attempt to improve upon them or revise them.

In the matter of the requirement for an Emergency Contingency Plan, Rule 36 in its current version follows the pattern of "affirmative action" currently required by many other regulating

agencies. The operator of a petroleum operation covered by the Rule must not only develop such a plan and submit it to the Commission, but he must acquaint all local residents and enforcement and assistance agencies with the potential danger and the provisions of the plan. He must conduct advance briefings of those members of the public to assure that they are informed and capable of taking positive action in the event of an emergency. You can perhaps see the similarity between those provisions and those of DOT Natural Gas Pipeline standard 49CFR192.

As an oil producer, you must have an Emergency Contingency Plan that *works*. You must see that your own hands, the general public, and all those you may need to carry out the plan are educated to the part each must play in the event of an emergency. It is ironic that H_2S has in some areas become so commonplace in low concentrations that the public—and worse yet, the oil-field hands—have lost their fear and respect for this killer. Some West Texas ranchers have even said, "I smell it so much that I'd get worried if I *didn't* smell it!" And oil field hands have reported to me that they have had 20 ppm electronic detectors activated in small town restaurants when the prevailing winds blew from sour gas fields.

Because of my strong orientation to oil field employee safety, I have felt that Rule 36 might have devoted more space and specific attention to the protection of employees. But, on the other hand, OSHA already provided a fairly rigid set of requirements for employee safety and the charter of the Railroad Commission was primarily directed toward public safety rather than employee safety. Rule 36 did and does provide for extensive employee training, however. Each employee must be trained in recognition of the hazards of H_2S. Surprisingly, this was an area not adequately developed until recently, even though the existence of sour gas and sour crude oil have been recognized as a fact of oil field life for many generations.

To effect this training for field personnel a number of excellent training aids have been developed. The API in 1976 issued a good general presentation of the subject in a slide/tape series, "Safe Drilling Practices in H_2S Areas."[3] Subsequently, in 1977 a more thorough treatment of the various aspects of work in hydrogen sulfide areas was commercially produced, examining detection, respiratory protection, rescue of victims, and treatment of casualties.[4] With student workbooks and certificates of completion of each phase of training, this five-part series is specifically designed for preparing oil field personnel to function in H_2S areas with maximum safety.

Of particular significance in the training of personnel is the rule pertaining to life support systems found in Section C, Subsection 12 (4), "Operation of Safety Equipment and Life Support Systems." To attain compliance with this statement and with the OSHA standards, one must have a written respirator program. This may be one of the most problematical aspects of the Rule to many contractors and operators; and it just may be the area of work which, if not done expertly, could actually increase the risk to life rather than reduce it. As I see it, this lack of specificity or lack of reference to some other standard, such as OSHA's 29CFR1910.134(b)[5] or ANSI Z88.1, for guidance may be one of the areas future revisions of the Rule should address.[6] The Rule could also be strengthened greatly from an employee safety viewpoint if a written respirator program were required to be submitted to the Commission for approval.

It would be inappropriate to recount the entire 13 pages of Rule 36 text here; but it certainly is useful, I think, to examine the format of the text. Its simplicity is probably one of the things that makes it workable. There are five Sections:

Section A. Applicability
Section B. Definitions
Section C. General Provisions
Section D. Reports Required
Section E. Exception Provisions

Of these, only Sections C and D merit our consideration here. The General Provisions section is in turn divided into 12 subsections which together do an excellent job of setting forth rules for safe H_2S operations. A brief examination of each of them with amplification of those not already discussed seems justified.

Subsection 1 - deals with test procedures and methods of detection and analysis for H_2S concentration. Only the Tutweiler method or

cadmium sulfate are usable in most instances with colorimetric tubes acceptable for use only in tanks or vessels. Recent advances in detection technology perhaps dictate a revaluation of this part. A number of new devices including electrochemical and electronic detectors are much simpler to use in the field and could enhance compliance.

Subsection 2 - discusses the determination of radius of exposure by the Pasquill-Gifford diffusion equations and has already been covered.

Subsection 3 - continues with the calculation of radius of exposure, but addresses the escape rate of contaminated gases under varying conditions.

Subsection 4 - provides for the wildcatter exploring the unknown. The assumed radius of exposure discussed earlier covered this.

Subsection 5 - covers the necessary provisions for achieving safety of the general public around tank batteries containing over 500 ppm H_2S in the vapor accumulation. It provides for warning signs and fencing.

Subsection 6 - tells what must be done if, after testing as prescribed in the above subsections, a given rig, well, pump, or other designated installation is, in fact, covered under the Rule with a 100 ppm radius of exposure exceeding 50 ft. Signs must be posted, security provided, and wellsite iron must be carefully selected to avoid hydrogen embrittlement.

Subsection 7 - adds some special applicability if the radius of exposure at 100 ppm is greater than 50 ft and cuts any public area except a public road, or if the 100 ppm radius is greater than 3,000 ft. Specifically, these additional requirements are the next two subsections.

Subsection 8 - requires that operators install safety devices, establish safety procedures and maintenance rules to keep them functioning. The nature of the provision is *prevention* rather than detection.

Subsection 9 - does a beautiful job of defining the requirements of an Emergency Contingency Plan.

Subsection 10 - addresses the sometimes necessary topic of injection of H_2S contaminated fluids into wells. Under these prescribed conditions such injection is prohibited unless specifically approved by the Commission.

Subsection 11 - covers drilling. Since drilling is probably the least predictable activity of the oil field, it is logical that it would receive special attention. Remember, if the encounter with H_2S can't be predicted because of lack of data (Subsection C 4), then a 100 ppm radius of exposure of 3,000 ft must be assumed. If it can be anticipated and that calculation indicates a 3,000 ft or greater radius of exposure, then a number of special additional precautions are necessary and are specified here.

Subsection 12 - covers training. This has been previously discussed.

Section D simply requires that the operator commit himself in writing by stating that he is in compliance or will be in compliance. An operator would have little or nothing to gain from falsifying in regard to compliance; but if he failed to comply as he had stated, that fact would probably be readily evident and irrefutable. In other words, the Commission has a powerful enforcement tool in the Certificate of Compliance.

Philosophically, Texas Rule 36 has a lot going for it. It assumes that the operator knows what must be done, it lets him take specific steps toward compliance, and it offers him the affirmation of the Commission that he has met their requirements. This attitude seems to be based on a degree of trust in the integrity and moral quality of the operator. Because of this, there appears to me to have been much less resentment and resistance to it than there has been to many less stringent rules by other regulatory agencies. The writer has conducted a series of specialized oil industry safety workshops across the nation and the state of Texas for the past five years.[7] The reaction to federal safety regulations which appear to be based on a total lack of trust in the integrity of an employer and to assume that the harsh fist of federal force alone will achieve compliance has been markedly different from the acceptance given Rule 36. Perhaps there might be a useful lesson there for the federal safety and health enforcement people.

Rule 36, since it is a State of Texas Railroad Commission ruling, is restricted in its applicability to the political boundaries of the state. Its effect, however, has gone far beyond those lines. Neighboring New Mexico has elected to consider Rule 36 as an accepted industry practice. This gives its state OSHA compliance officers the power to cite New Mexico operators for failure to comply with Rule 36 (with the exception of the reporting requirements) under the General Duty Clause. Colorado, Wyoming, Utah, and California are using this rule as a source document for preparation of their own state regulations. Michigan drew heavily upon Rule 36 in the preparation of its recommended practices.[8] NIOSH, the National Institute of Occupational Safety and Health, issued a criteria document in mid-1977 which recommended to OSHA the framework for a new standard specifically for H_2S environments. Again, it obviously drew heavily upon Texas Rule 36, but it seemed somehow to lose the imprint of its oil industry origins.

In summary, Texas Railroad Commission Rule 36 is a remarkably successful regulation. It could yet be rendered ineffective and obnoxious by inept enforcement, but that does not appear to be the case thus far. With a continued administration by enlightened personnel, it is hoped that the industry and government can continue to work together to evolve even more effective control over H_2S.

REFERENCES

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5. Federal Register 29CFR1910 as revised. U.S. Government Printing Office, Superintendent of Documents, Washington, D.C., June 24, 1974.
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8. "Guidelines for Sour Oil and Gas Wells and Associated Facilities," State of Michigan. Michigan Department of Public Health, Lansing, Michigan, July 1976.

*Available as a five-part slide and tape series (Box 4395; Zip 67204).