The Psychology of Well Control

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ABSTRACT

Serious well control problems in the field are more often the result of inappropriate human behavior than of any other single cause. This behavior is as much a function of psychological factors as of equipment, technique or knowledge. Management decisions that include consideration of psychological factors relating to perception and motivation offer opportunities for eliminating the human mistakes that too often result in dangerous and expensive well control incidents.

TEXT

I am grateful for the chance to share some observations with such a wide range of people who have expertise and responsibilities touching on well control. Perhaps my conclusions will seem obvious to some. But consideration of the effect of psychological factors on well control behavior is certainly not a standard or well documented topic. So I hope it will provide at least some food for thought.

Let me give you an idea of where my thoughts come from. I became involved in well control training for Sedco Forex while working in the North Sea in the early Eighties. But with with an academic background encompassing both engineering and Psychology, I found myself making observations on the topic of field application of well control practices with an appreciation for technique, but also a pre-disposition to focus on human behavior.

And this is what interests me most today -- human behavior in well control situations.

Although I have taken the liberty of describing my topic as the "Psychology of Well Control" , I don't mean to introduce obscure theory derived from studies of rats running in mazes. Nor do I want to consider interpretation of dreams. Instead, I want to focus on some straightforward observations about things that affect human behavior -- that is, what people do when confronted with well control related situations. Psychological concepts relating to perception and motivation, in particular, are as applicable in well control situations as in any other area of human activity.

But let's avoid an esoteric discussion of psychological concepts in favor of a sample examination of a relatively simple field example that will, I hope, illustrate the importance of these factors in field practice.

Let's consider a situation in which we have a driller whose mud pit volume alarm sounds, indicating an increase in mud volume in the active pits. In a normal drilling situation, routine well control practice calls for the driller to recognize this as a classic indication of a potential kick in the well. Since the danger and difficulty of handling a kick generally increases in proportion to kick volume, drillers are often trained to respond by stopping to do a flow-check in a circumstance such as this. If mud continues to flow from the well when the pumps are turned off, a kick is indicated and the well would normally be shut in with the BOP's in accordance with company policy.

I think most would agree that most drillers in the field today would be able to describe this sequence of events with little difficulty. And, given a reasonable approximation of familiar rig equipment, virtually all experienced field hands could demonstrate an ability to enact this sequence.

Yet, year after year, we hear of well control situations resulting from, or complicated by, a dramatic failure of trained rig personnel to perform this simple sequence of behaviors in a timely fashion. What are some possible reasons for these failures? Lack of knowledge of principles? of policy? of technique? of training?

Let's consider how some "psychological" factors might provide some explanation here. I'll start with "Perception".

Perception is the process of becoming aware of of physical reality. Since we are bombarded continually during our lives by incredible amounts of sensory data, it can be argued that a major mental activity is that of screening sensory input, allowing perception of only a small subset of available data that the brain considers relevant at a given moment. When the brain is confronted with input that fails to support a concept of reality, it can quite actively prevent that data from being objectively processed.

What this means, of course, is that it is quite possible for things to occur within our sensory range without our becoming aware of them. That is why alarms on gauges located within our range of peripheral vision are essential to direct our attention to information that might be routinely screened from our stream of consciousness. But it also explains why it may be surprisingly hard to correct a faulty perception or belief once it has been formed.

Now when our imaginary driller hears his PVT alarm going off, it may well be his first opportunity to perceive a trend that is occurring on his gauges literally before his very eyes. Depending on the sophistication of the instrumentation, the driller may be able to confirm this newly perceived piece of information on a separate gauge or even review recently recorded data that can inform him of the rate of change.

But his ability to do any of these useful things is too often limited in practice by the sensory overload of a 100 decibel alarm horn located three feet from his ear. Only after dealing with the alarm (instead of the well), is he likely to stop to consider how to react.

Now in well control training, it is perhaps simple for him to immediately begin to perform the above mentioned procedure. The student will often start with the (correct) perception that the alarm indicates a well kick.

But in a real world situation, he may be confronted with at least two possibilities:

1) the well is kicking
2) someone in the mud pits has done something to affect the pit volume

Without advance knowledge that a kick was likely, the data from the alarm may be ambiguous, equally supporting either of these conclusions. In situations in which ambiguity exists, it is a human characteristic of many people (consider optimists) to consistently accept (and act on a belief in) the less unpleasant or undesirable alternative explanation. (Consider, as another example, an optimist suffering mild heart attack symptoms who convinces himself it's probably just indigestion.)

In cases like this, it is a common observation that drillers are more likely to pick up the phone to call someone in the mud pits to confirm the instrument reading than they are to immediately flow-check as prescribed by doctrine. Does it matter? Yes it does, since not only is time wasted which, during which in an actual kick, the situation would be deteriorating, but also an opportunity is created for acceptance of plausible, but false alternative explanations for the observed phenomenon. And once this possible false explanation is accepted, the driller's brain will unconsciously operate to cling to this explanation in spite of further sensory input.

In other words, a pit watcher who speculates to the inquiring driller that it was perhaps an adjustment to mud cleaning equipment that was responsible for the observed pit level change may be contributing to the driller's acceptance of the "innocent" explanation for the alarm. This may cause a driller to forego the check required by prudent policy, perhaps resulting in a prolonged failure to perceive reality correctly -- that is, that the well may be flowing as well.

This behavior of "explaining away" undesirable observations shows up with remarkable regularity in case histories of well control incidents and can surely be labelled the root cause of a number of well known industrial catastrophes (including the likes of the Three Mile Island and Chernobyl nuclear incidents).

It is worth stressing that the problem here has nothing to do with knowledge, skill, brainpower, or company loyalty, but is a result of well-meaning individuals acting in normal and predictable human ways. In short, people often perceive (and believe) what they want or are prepared to perceive (or believe), rather than what is real.

But what, you may wonder, would have been the result of having a natural (or trained) pessimist on the brake who always assumes the worst? Such a driller might well suspect the worst ("the well is kicking and I'm the unlucky sap who has to interrupt an important or costly drilling operation to handle it"). As he flow checks to confirm his worst fears (while the optimist would still have been on the phone to the pits), what might his further thoughts be? Might he be thinking about the consequences of the next step?:

- "If I close the well in, we'll probably end up with stuck pipe and there will be hell to pay."
- "If I close the well in and it turns out that the flow is due to U-tubing of unbalanced mud, or "just" some trip gas, or just the well "giving back some mud" when excessive overbalance is reduced, there will be hell to pay."
- "If I close the well in and we damage or prematurely wear out our BOP elements, we'll have down-time and there will be hell to pay."
- "If I close in the well, I'll have to wake the Boss, who doesn't like me nearly as much as he likes his sleep, and there will be hell to pay."
- "If I close in the well and report a pit gain of 7 barrels, no one will believe that there is a kick since this is less than the

> normal flowback that occurs when I stop the pumps. I'll be considered a wimp or a nutcase. I'd better make sure there really is a problem before I "risk" closing in."

Thoughts of this nature (and those who have been in the driller's shoes in the middle of the night on a tricky well should be able to relate to this) are common in the field. They all tend to prevent the driller from making the decision that would render well control much simpler -- to close in the well with a minimal influx.

In fact, case histories again suggest that the decision to close in a well is often delayed until long after all ambiguity has ceased to exist. Sometimes, the only indicator that seems to overcome field personnels' reluctance to make the decision to shut in the well is mud actually spewing through the rotary table. When the situation has been allowed to progress to this point, it is little surprise that the well kill is substantially more difficult.

We could continue to imagine our driller as he confronts one decision after another, hesitating at each step until events overwhelm him and gut reaction often prevails ("close the well in anyway you can regardless of training to do a "soft" shut in, concern for operating or well pressures, string position, etc.). But the point should by now be clear that the driller's natural, human tendency to inaccurately perceive the situation and his concern for consequences of his decision can dominate his well control behavior at this early, but critical stage. This is in spite of his technical competence and field skills.

So, what can be done to increase the chances that a driller will act in accordance with what he has been trained to do?

First, company policies should unambiguously emphasize desired behavior -- regardless of consequences of that behavior. Such policies must be backed by a credible management commitment to support and stand behind those who comply. This can help remove conflicting motivation in emergency situations. If, for example, our driller didn't have to even imagine being blamed for stuck pipe or loss of productivity if he closed in the well, he would be more likely to perform as trained.

Second, essential procedures should be kept as simple as possible. Every small step or decision in a sequence that can be eliminated increases the likelihood of the procedure being followed as per policy. This concept is relevant to the debate as to the relative merits of hard versus soft shut-in methods; a hard shut-in with the annular preventer has an undeniable and, I believe, major advantage in its simplicity. It is unwise to underestimate the importance of keeping steps simple if they must be performed without fail in moments of stress or confusion.

Third, rig instrumentation should be designed to inform, not intimidate. Systems that can integrate sensors and perform some selective processing or interpretation of information can at least partially relieve the driller of the stress of being solely responsible for rapid decisions in moments of potential confusion. Complex instrumentation layouts that consist of a hodge-podge of unrelated instruments vying equally for the driller's attention are a hindrance to efficient action. A key design consideration should be simplicity of operation and minimization of less relevant data.

Fourth, rig personnel actually handling well control situations should not be expected or required to perform theoretical calculations that contribute less to safe handling of the situation than they add to procedural complexity. Where such calculations are needed, it is often sufficient to substitute pre-kick data for calculations typically emphasized as necessary for well control. The greatest proportion of information on a typical kill sheet, for example, can be routinely kept adequately current by having it updated once or twice a day. Changes to most values (such as change in open hole volume after drilling 10% more open hole) are generally less important to concentrate on than are other kill considerations such as equipment lineup, influx disposal, etc. Computer programs designed to assist the rig crew in calculation and analysis of well behavior during kicks hold promise so long as manipulation of the programs is not permitted to supercede control of the well as a goal.

Fifth, communication at the rig and the office should be routine and thorough enough to help prepare drill crews to rapidly respond by helping to maintain an air of expectation of the potential for the development of well control situations. Once someone states that a well problem is unlikely, it is far less likely that a driller will correctly identify early signs of problems than would be the case if he were encouraged to keep his guard up. Actions such as a decision to not hire a mud logging service for a development well should not be allowed to imply that a kick can't occur; kicks on development wells are anything but unusual in the industry today.

And finally, training activities must focus more attention on teaching students to <u>act</u> rather than simply <u>understand</u>. Knowledge of principles, equipment and technique is certainly important. But it is important to make a conscious effort to include consideration of thoughts, emotions and psychological tendencies that will certainly affect behavior in high-stress, non-routine well control situations.

CONCLUSION

In conclusion, strictly analytic, technical and ever more sophisticated approaches to well control are unlikely to succeed as long as human needs, fears, and perceptual or cognitive limitations are permitted to dominate behavior in actual well control situations. As concerned professionals, we need to increase our awareness of and efforts to understand these "human" factors. And they must be kept firmly in mind while developing policy, procedures, rig systems, and training activities.

Thank you for your attention.