

Forecasting Significant Incidents in Urban Gas Fields

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Introduction

Imagine a densely populated urban area with 2333 people per square mile and say, 300 square miles in area. Suppose a shale bed gas play underlies this urban area and that the gas drilling industry has decided to fully develop this gas play. The industry has a plan for assaulting this city. First they will send in emissaries to determine the attitude of the local government toward the project. If there seems to be any resistance or doubt, the first step is to finance the campaigns of challengers who will support industry plans. Next, they send in the PR team to announce the project and stir up support among the business elites by appealing to greed. During this phase a truly regal budget is available to promote the project. The city council is courted and told how rich everyone is going to be. Neighborhood associations are co-opted, and if possible brought under a co-opted umbrella organization that is, itself, controlled by the co-opted mayor.

Next, they send in the landmen for door to door high pressure sales pitches to resident mineral rights owners. They promise “no surface use” leases, offer signing bonuses, and speak no evil. That is, they don’t say that drilling is a heavy industrial activity fraught with dangers that can result in massive fires, explosions, flying casing pipe, escaping unodorized gas that can asphyxiate humans—that sort of thing. They are careful never to mention pipelines at this stage. Nor do they mention compressor stations, gas processing plants, the millions of gallons of fresh water needed to complete each well, the fracking operation chemicals and high hydraulic pressures, the noise, the produced “water”, the heavy truck traffic, the use of eminent domain to run 16 inch 200 psi raw wet unodorized gas gathering lines a few feet from people’s homes... none of this is ever mentioned...that is, until the leases are signed and the hush money has been distributed.

Under this assault plan it is claimed by the industry and their coopted government officials that if this weren’t perfectly safe they wouldn’t be planning to do it. Hands are waved, brotherly love is assured, safety is proclaimed, and the project lurches forward to rapid completion before the citizens have time to realize what all this really means for their community.

That is what is unfolding in Fort Worth. We are presently at a point where 1376 urban wells have been permitted, eminent domain proceedings have begun, and vague industry forecasts say that at final build-out there will be 3000 to 7000 perfectly safe gas wells and their network of perfectly safe gas gathering lines in place underneath the front yards of the happy, rich residents.

In August 2007 I became involved in this drama. Chesapeake wanted my neighborhood to approve a plan to produce the minerals under us from a drilling pad

that was to be situated 30 feet from our SW Fort Worth water tower, 30 feet from a busy interstate, 30 feet from a neighborhood swimming pool, with single family residences within 100 feet and an elementary school 800 feet away.

That is when, as a retired research physicist and chemical engineer, I took on the task of determining just how dangerous this activity would be. We already knew of the dangers of the chemicals, and we had many examples from across the nation of just how difficult it is to change the course of such an industrial assault by appealing to public health issues. So, I decided that public safety would be my issue.

My task was to determine how frequently we could expect a "Significant Incident" (SI) inside Fort Worth when the industry is finished with their build-out phase.

The Search for a Reliable Measure of Performance

It was no surprise to me that the industry and their regulators (who are really oil and gas development facilitators) did not provide such a measure. All they are interested in doing is creating the illusion of safety and regulation.

The US DOT does, however, collect historical data on Significant Incidents and a year-by-year inventory of pipeline miles cataloged by a variety of factors. I used these data in combination to produce a meaningful and useful measure of performance for my purpose. This effort was complicated and required a lot of work because the need for such an analysis was unanticipated by the regulatory agencies that archive the raw data.

The Proper Use of Detailed Accident Data and Pipeline Data

The purposes of regulation ought to be to learn from mistakes that lead to disaster and to define inspection and monitoring requirements that mitigate risk and decrease the probability of disaster. To do this job properly it should be possible to determine what the probability of disaster per mile of pipe is and how the probability of disaster changes with implementation of new rules.

The trouble is that the regulators and the industry don't want to know what this probability is, because that could lead to development resistance.

I found that I was breaking new research ground with my work. To my knowledge there is no other similar analysis available.

Definition of a Measure of Performance

The factors that are the proximate cause of Significant Incidents can be categorized as follows:

Density of gas wells and gathering infrastructure

Age of the field
Population density
Natural construction material decay and failure rate
Human activity

Accidents do happen regardless of what is done to mitigate risks. What is of interest to me is, given modern regulation, inspection, construction, and maintenance best practices, what is the expected accident rate as a function of gas well density and its associated infrastructure?

Data Analysis and Limitations

Significant Incident data were collected from the Texas Railroad Commission for the period 2004 through 2007 for the Barnett Shale play. For the same period and geographical area the US DOT pipeline database was searched for gas gathering line data. The Texas Railroad Commission data for number of active gas wells per year for the Barnett Shale for the period were also collected.

We are attempting to forecast significant incidents for Fort Worth, the only densely settled region in the Barnett Shale. Since development in Fort Worth has lagged the rural areas the data we have from 2004 through 2007 are for sparsely settled areas, this means that humans and their activities are not strong contributors to the accident data we have available. Additionally, the age of the wells and gas gathering infrastructure is yet small. Thus, the historical accident rate data we have should be less than that we might expect in the future inside Fort Worth.

Over the period of the analysis the number of active wells in the study grew from 817 to 6540. The number of gas gathering miles of pipeline associated with these wells was unavailable. However, in general, the number of gas gathering pipeline miles grows in proportion to the number of gas wells as the build-out proceeds. At some point development becomes a matter of in-filling drilling pads with additional wells, and while the growth of pipeline miles decreases, the pressure in the gathering lines increases due to the added wells on each pad. The increased pressure and raw gas flow volume increases the wear and tear on the inside of the pipe. So during the build-out period one would expect the number of accidents per well to increase.

A plot of the number of Significant Incidents vs number of active wells for the period of interest (2004-2007) is shown in Figure 1¹. There were a total of 9 incidents in the period, and, as expected, the number grows with the number of active wells for the 4 year period.

What this graph says is that for any randomly chosen collection of 3000 wells and associated infrastructure in this field, there would be about 2 Significant Incidents per year. Recalling that this data is for a sparsely populated area and young pipelines it is conservative to say that Fort Worth's future average rate of Significant Incidents is

¹ See number of Gas Wells vs Explosions.xls, Analysis worksheet Graph at about Q85

about one per 6 months. Common sense would inform us that the actual rate should be greater by some unknown amount.

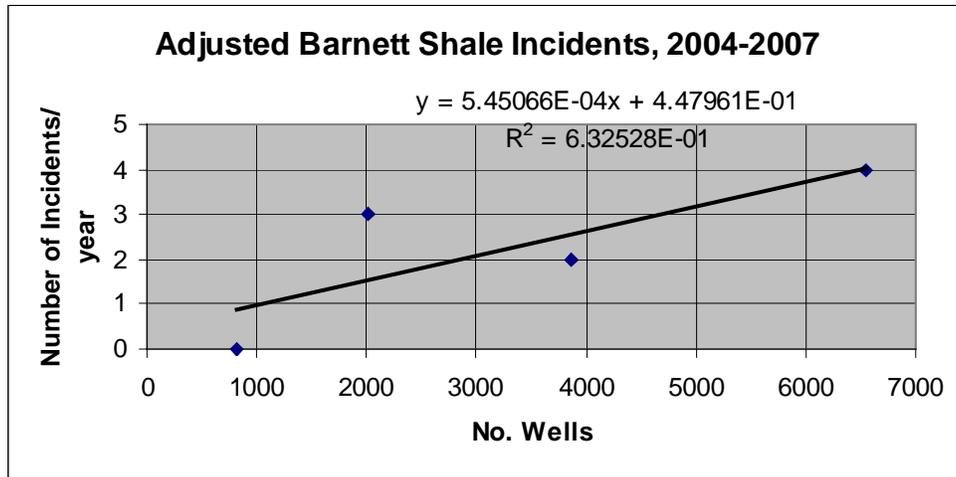


FIGURE 1—Significant Incidents vs Number of Active Wells in the Barnett Shale, 2004-2007

Additional Analysis

This analysis almost certainly underestimates the average rate of occurrence of Significant Incidents in Fort Worth that we will experience here as a result of gas well drilling. We really don't know how many wells industry plans to drill here, for one thing. About a year ago Chesapeake said there would be 3000 wells inside Loop 820 (our outer loop). That is an area of about 160 sq mi. The area of Fort Worth is about 300 sq mi. So, if Chesapeake's casually offered number of wells is taken as an accurate figure, that would then imply about 5650 wells in Fort Worth at full build-out, or 34 acres per well.

Another estimate, casually thrown out by an unknown industry representative, was 7200 wells inside Fort Worth. This is about 27 acres per well.

Yet another industry estimate is that at full build-out there should be about 40 acres per well. This would convert to 4800 wells inside Fort Worth.

These estimates would imply an average SI rate of between 2 and 4 SI's per year.

Implications for Residents

A Significant Incident is a rather memorable and often a spectacular event. Such events, occurring as often as the foregoing analysis suggests, would have a very negative effect on life in Fort Worth. We would have a national reputation as a bad place to live. Insurance rates for homes within some distance of a pipeline would soar

and make homes unaffordable for existing homeowners and undesirable for potential homebuyers. Home values would plummet. Residents would tend to move away because of the dangers of fire and explosion. Bond ratings for the City and School districts would plummet. Tax rates would increase as bond ratings fall, but eventually a decreasing population would drive tax revenues down. In short, Fort Worth would become the next Detroit or Flint, Michigan.

Worse, this scenario is the result of the abdication of the duty of the City Council to provide for the public safety. There is no way to forecast the number of injuries and deaths that will result from gas related accidents. It represents a major crime against the public for the benefit of a few predatory corporations and a few individuals.