Evaluation and Analysis the Implemented Actions to Improve the Techniques for the Water Treatment

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Summary *– The theme of the oil industry is a popular one. The consequences of the hydraulic fracturing are bad and harmful to peoples' lives. The effects that comes with the fracking are that harm the air, the soil, and the water. Studies binds the earthquakes with this, but no one had proven it. When the researcher moved to Midland, Texas, since you get near Pecos, Odessa and Midland (cities in the Permian Basin), automatically detects bad smell of rotten egg. Some days later, noticed that the water in the apartment smelled like the smell on the air. This project considered this issue. The quality of water, here in Midland and the nearby cities that are accessible to the hydraulic fracking areas, are in bad condition. This project will be investigating the implementations of quality controls in water treatment of the city of Odessa.*

Terms – *Depot of Water, Hydraulic Fracturing, H2S, Reverse Osmosis.*

INTRODUCTION

This city and the ones in the Permian Basin have a common denominator: the bad smell of the environment and the complains of the water. The complains are for the color and also the bad smell that comes with the water. Besides how bothering is this to their daily lives, it is clear that will be harmful too. Their residents should know where this come from and why; so, it is important to investigate the process of fracking.

Problem Statement

It all started in the Permian Basin. The Permian Basin is a collection of smaller basins, but in all, covers 75,000 square miles—making it one of the larger basins in North America. In the Permian Basin, the City of Odessa is located, and is one of the largest cities in West Texas. It has been ranked as the fastest growing small city in United States of America (USA). Also, at 15 minutes towards Midland, Texas, is located the childhood house of the President H. W. Bush, the father of former president George W. Bush.

In the Permian Basin, crude oil can be found. The crude oil was founded underground in liquid state. The oil is a mixture of liquid hydrocarbons [1]. A hydrocarbon is a compound of hydrogen and carbon. It has many uses in the industry, besides filling up the tank of any car; it is used for heating and electricity generation, asphalt, and road oil, to make chemicals, plastics, and synthetic materials.

The specific problem of this project is that people complain about the quality of water. The complains are about the color and the bad smell (odor) that comes out from the plumbing of their houses. That smell is the Hydrogen Sulfide (H2S). The H2S produces a bad smell that is compared to the smell of a rotten egg. This gas is commonly found during the drilling and production of crude oil and natural gas, in addition to wastewater treatment and utility facilities and sewers. The gas is produced as a result of the microbial breakdown of organic materials in the absence of oxygen. The H2S is colorless, flammable, and extremely hazardous. Its health effects may vary depending on the level of the hydrogen and the duration of exposure.

This is a very important study to develop. As residents of those cities in the Permian Basin, besides living from this oil industry and received a good economic remuneration, residents claimed good quality of life and healthy lifestyle. People health is compromised and will be affected in short or long term, specially the kids and the elderly people and those who have the Immune System

compromise, because the quality of water that community are supposed to be receiving is not good. According to the water company, if the water doesn't exceed the federal regulated parameters for each component of chemical, community are out of risk, but if this chemicals accumulate in their bodies for a long time, what will happened next?

Objective

The objective on this project is to evaluate the implemented actions by the Department of Water because this is a common problem in the area, and it seems to never get better. The investigator will look what is this new project that they implemented in 2016 and verify that the new requirements are working properly.

Contributions

The contributions on this research may vary. It can be a change of chemicals or measurements in the water treatment, substitutions or process modifications. Everything as it arises during the investigation can be considered and contributes to solve the problem. The smell, the color, and the quality need an explanation, not just assumptions.

THEORETICAL BACKGROUND

At this point, the investigation will be focused on the city of Odessa, Texas. How the oil is exactly extracted. Going back to the introduction and problem statement, the oil is found underground. Watching some videos on how the fracking works [2] [3], the process is as follows: shale reservoirs are usually one mile away or more below the surface. The drilling occurs up to 13,000 ft. below the surface. Steel pipes called casing cemented in place to provide a multilayered barren to protect fresh water aquifers. A hole is drilled straight down using fresh water-based fluids. Which rocks the drill bit, carries the rock cutting back to the surface and stabilizes the wall of the wellbore. Then, the drilled pipe is removed and replaced with steel pipe, called surface casing. Next, cement is pumped down the casing. When it reaches the bottom, it is pumped down and then back up between the casing and the bare hole wall.

The first step for completing the well is the creation of a connection between the final casing and the reservoir rock. This consist of lowering a specialized tool, called a perforating gun, which is equipped with shaped explosives charges down the rock layer containing oil or natural gas. This perforating gun is then fired, which created holes through the casting cement into the target rock. This perforating holes connect the reservoir and the wellbore. Since these perforations are only a few inches long and are performed more than a mile underground, the perforation gun is then removed in preparation for the hydraulic fracturing [4].

The process consists of pumping a mixture of mostly water and sand, plus a few chemicals under controlled condition into deep underground reservoir formations. The chemicals are generally for lubrication, to keep bacteria from forming and help carry the sand. Some of the additives are: acids, chloride, polyacrylamide, ethylene glycol, sodium/potassium carbonate and more. The fluid is sent to trucks that pump fluid into the wellbore and out through the perforations that were noted earlier. This process created fractures in the oil and gas reservoir rock. The sand in the frac fluid remains in their fractures in the rocks and keeps them open when the pump pressure is relieved. This allows the previously trapped oil or natural gas to flow to the wellbore easily [4].

The initial stimulation segment is then isolated with a specially designed plug, and the perforating guns are used to perforate the next stage. This stage is then hydraulically fractured in the same manner. This process is repeated along the entire horizontal section of the well, which can extend several miles. Once the simulation is complete, the isolation plugs are drilled out and production begins. Initially water and then natural gas or oil, flows into the horizontal casing and up the wellbore [2] [3].

In the first initial phase of production, when water comes out, it is recovered 15% to 50% and can be reused or will be disposed, accordingly to the government regulation. The whole process of

developing a well typically takes from 3 to 5 months, a few weeks to prepare the site, 4 to 6 weeks to drill the wall and then 1 to 3 month of completion activities, which includes 1 to 7 days of stimulation [5].

This 3 to 5-month investment can result in a well that will produce oil or natural gas for 20 to 40 years or more. After all this is done, pipes are cut off 3 to 6 feet below the ground level. All surface equipment will be removed and all pads will be filled in with dirt or replanted. The land can be used again by the landowner for other activities.

The risk of ground water contamination and surface liquid spills can occur but are not limited. When the fluids that were injected in the returns to surface, but up to 30% stays underground, is where the ground water becomes contaminated and the problems with fauna and diseases begin. Besides the information of the water pollution, it is important to know that, for each well that is constructed to extract oil, the increment of water use will be much higher. That means that more millions of gallons of water will be contaminated with the chemicals. Even though that the companies that dispose the water are supposed to follow the federal rules to make the disposal, it has been cases where they injected those contaminated waters in isolated underground floors, like a permanent solution.

In the reports of the city of Odessa, of the Water Quality Department, they make a point in the report of 2016 that they will be implementing a new source of water purification prospectively [6]. After investigating this new project, they were implementing the Reverse Osmosis (RO) treatment. To begin with this new process, the city had to go thru a cost estimation project that will depend on the level of operational skill, level of maintenance required, and the energy requirements. Considering all these expenses, they decided to go with the RO.

In the annually water report, states that besides using water from water wells, the city also obtains the water that citizens consume from other sources. Those sources are Colorado River Municipal Water District (untreated), Lake Ivy, Lake Thomas, and Lake Spence (surface water). Also, the city may receive water from Ward and Martin Counties, as needed to meet water demand [6]. Unfortunately, also those sources are susceptible to certain contaminants too as: microbial contaminants, inorganic contaminants, pesticides and herbicides, organic chemical contaminants, and radioactive contaminants.

As perceived and the information included in this research, even though that the department is taking the measurements to offer a good quality of water, it goes beyond that. It is not enough the RO, neither the standard and designates water uses. They are responsible of providing the high-quality drinking water and the only thing that intervenes with the water are the plumbing. The Department of Water is not in charge of the materials used in plumbing. If the materials used in the plumbing are affecting the quality of the water, they are not responsible for this.

Since the researcher moved to Odessa, Texas, making an investigation about the water in this city is a must. So, to do this research on the Quality Water Reports of the City of Odessa, some information was found. Water company implemented a new project in 2017 that will help reduce the smell, the color, and the chemicals in the water. Reading that they were implementing a new project make the researcher happy, but at the same time concerned because if the water was still like that, after the implementation of the project, community should worry.

METHODOLOGY

The objective of this research is to evidence why is the water coming polluted, even though the city is taking the necessary steps to provide residents clean water. The other objective is to present other option of water purification, besides RO. The City of Odessa offers a Quality Report of the water each year. The following information sources where used to acquire information:

- Water quality reports
- City news (videos)
- Complains

- Books
- Database
- Catalog
- Newspaper
- Videos

RESULTS AND FUTURE WORK

In the year 2016, they announced on their report that they initiated a project that could potentially provide RO water to all, citywide. That was because the quality of water was not good enough previous years. The RO water means better quality water, longer lasting appliances and equipment, and cost savings [6].

In the year 2019, came out a notice of the CBS7 (news in Odessa) that there were about 200 quality complaints only in that year. In those complains was established that the water was dirty, yellow, and it smell like rotten egg [7].

If previous information mentioned the date when the city starts the RO project (2016) and the year of the complaints (2019), there are 3 years in between. Lectures established that the membrane of the RO life was 2 to 3 years [8]. It is a possibility that the city did not do the required maintenance to the membrane or did not took the samples of the water correctly to pick the correct membrane for the RO treatment.

In other information available recognized that the bad smell in the plumbing is because of the accumulation of the H2S. The continuous flow of water with chemicals corrodes the pipes and that porosity causes all those chemical wastes to accumulate, specially the lead and the H2S [9]. To remove H2S from the water is needed an iron sponge process, that treats digester gas by passing it through a permeable bed of iron sponge.

Here are the most important points of this investigation because they will drive to a conclusion:

- The city buys water from different counties (that could be also contaminated) when city own water it is not enough and use the same city underground water.
- In the process of flow up, the chemicals may spill to the ground.
- The department can provide an efficient quality of water to residents, but if the plumbing of the city is corroded and contaminated, then they do not assumed any responsibility because plumbing is not under their management.
- The RO is an effective treatment because they measure the water contamination before buying the membrane of the RO. They measure to have an estimation of the pollution and chemicals.
- The membrane of the RO has a life of 2 to 3 years.
- The new project of RO of the Department of Water versus the massive complaints for the quality of the water are 3 years apart.

In relation of the water report of 2019 and the starting the project of RO in 2016, it is a huge coincidence that since the 2016, when they started the project of RO, to 2019, it were over 200 complaints, only in 2019. That is 3 years apart; exactly the total life of the membrane of RO.

This investigation will not go forward with the Department of Water. It will go forward with the company that is in charge of the plumbing of the City. Must be known if the plumbing is affected by those chemicals or not.

CONCLUSION

At the end of the investigation, researcher have learned some points that shows that the treatment that the water is receiving is the correct one. Another point that was learned was about the process of fracking and the consequences, later on, the inform of the quality report that the city reports, the federal government require the city of Odessa to monitor exactly those substances because, in more quantities, are harmful to life. In the investigation of the RO treatment, it was concluded that is effective because it is established in the reading that, to pick a process of purification; so, they need to do water testing before the city invest in a treatment. They will not invest in a treatment that will not give

results and they need to report those samples to the federal government.

After this investigation and looking for news and complaints that can validate what is all about, this complains will be maintained because the fracking is something that will not stop until the crude oil is over. For now, is something that residents need to deal with and buy the best water filters and change it monthly because the contamination is heavy.

The news that was reported in 2019, that was telling the public that were around 200 complains that year, it can be concluded that The Department of Water did not make the correct maintenance of the membrane, after their implementation. After this situation, the city incremented the portions of the chemicals that clean the water, to have faster results and also gave the right maintenance to the membrane.

It is important to investigate things before researchers assumes. There are many complaints about the quality of water, with the smell and the color. It is very disappointing living in a place that economically you can be stable, but when it comes to the use of water, daily, and residents perceived the smell, people get mad.

As residents, no other choice is available than to invest on a water purification system, of a very high quality, and install it on the sewer that will go connected to the house, so citizens have fresh and clean water for cleaning the cloth, washing the dishes, cooking, and the most important, for drinking.

Meanwhile, researcher could not reach a concrete conclusion about the water treatment, because they cannot rule out the possibility that it is not the pipes that affected the quality of the water. In the meantime, it was settled for knowing that through evidence and visual corroboration, the department is working efficiently, and, in the meantime, the investigation of the state's pipelines will be carried out.

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