CRITICAL ASPECTS ON SYSTEMS ECOLOGY EXPLORATION AND EXPLOITATION OF SHALE GAS

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Abstract
Exploitation of shale gas wells require the use of millions of gallons of water. Water is mixed with the sand and the chemical additives to give a fluid which will be injected to the walls crack formation clay [1, 2]. Some chemical additives include biocides, lubricants and detergents.
Hydraulic fracturing operation may have adverse consequences on the environment: pollution of groundwater and soils, landscape degradation or noise [3]. These issues without taking into account gas leakage, may contribute to the greenhouse effect.
The paper presents some specific issues responses exploration and exploitation of shale gas.

Keywords: *shale gas, Hydraulic fracturing operation, greenhouse effect*

1. INTRODUCTION

The term gas refers to unconventional natural gas resources accumulated in complex geological reservoirs with low permeability, commercial exploitation of which can only be achieved through the application of sophisticated and often expensive oil operations. There are three types of unconventional gas resources: gas tanks (sand) tight (tight gas sands), gas or shale gas argillaceous rocks (shale gas) and coal gas (coalbed methane).

Figure 1 shows a diagram of a geological section three types of unconventional gas resources.

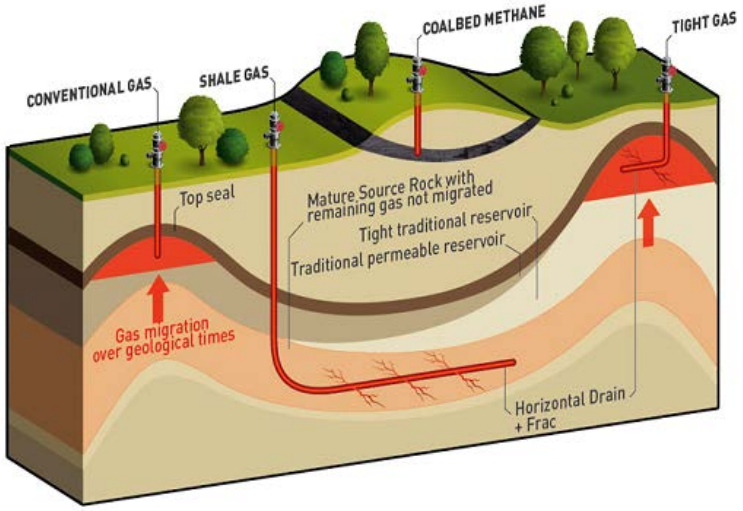

Fig. 1. Geological section (unconventional resources) [1]

Currently, for shale gas using horizontal drilling and vertical wells (deviated). The trend in the future, is based more on horizontal drilling, taking into account the expansion and exposure optimized geological formation in this case. Currently, the horizontal drilling a combination of a hydraulic fracturing operation, carried out in several stages, has led to a significant increase in productivity shale gas well.

2. HYDRAULIC FRACTURING

The aim of hydraulic fracturing operation consists in the intersection and opening of cracks is present in a reservoir and also the generation of new cracks. This system of cracks is necessary to create new channels through which natural gas can enter the probe. In this sense, the system is injected fluid has component, water, chemicals and sand.

Granular materials (sand and chemicals) will result in explosion in such a way that the formation of cracks is obtained for the release of gas will then go on the surface by the probe (fig. 1). At the same time, the sand is injected and prevent cracks reblocarea small (of the order of millimeters.

The types of these chemicals used in this operation include: [3]: 1.2 benzisothiazolin-2, 1,2-benzisothiazolin-3, 1,2,4 trimethylbenzene, 1,4-dioxane, 1-eicozen 1-hexadezen, 1-octadezen; 1 tétradezen, acetic anhydride, acetone, acrylamide, etc. (composition and content of each product or mixture were kept secret by the manufacturers and users of Americans who expressly asked the Senate that the law does not require them to disclose the names of those products).

According to experts from Halliburton and other operators in the area [2], more than 99.5% of the fluid used in hydraulic fracturing consists of water and sand. Sometimes sand may be coated with resin or ceramic bearings replaced.

You must start from the observation that the role of water in the fracture is crucial. Operation of wells require the use of millions of gallons of water (average of 8-35 million for each fracturing operation).

It also believes that a hydraulic fracturing operation may have adverse consequences on the environment: pollution of groundwater and soil, landscape degradation, noise, etc. This without taking into account the leakage of gas, may contribute to the greenhouse effect.

Progress monitoring and control of hydraulic cracking of gas-rich layers (typically, less than a mile below the water table) make the risk of direct communication between layer exploited groundwater is unlikely. Moreover we believe that it should be more emphasis on achieving proper consolidation (casing and cementing) probe, achieving control geophysical logging etc [4, 5, 6].

It is also true that groundwater may be affected in an indirect manner: waste water production or uncontrolled outflow of fluid from the surface; risks related to the management of the settling basin; risks related to wastewater and chemical additives tank trucks; risks related to contaminated water treatment.

To reduce the risk of groundwater pollution in the first place need to optimize programs casing and cementing horizontal wells. At the same time, the protection of groundwater, deposits and environment must react on the nature and composition of chemicals used in the fracturing operation.

At the same time the beginning of 2012, an interdisciplinary team of researchers from the Energy Institute of the University of Texas in Austin [6] announced the results of scientific research on various aspects of activities related to hydraulic fracturing: groundwater contamination; Leak on the soil surface; programs into the atmosphere; use of the water resources; residues resulting from drilling activity; Available eruptions; traffic; noise.

The research covered all phases of development of the main deposits of shale gas in Barnett, Marcellus and Haynesville USA.

The main findings are:

• did not result in the contamination of the aquifer with chemical or fracturing fluid leaks ball;

• have identified many non-conventional contaminants in hydraulic fracturing operations having such as leakage loss cased columns and cementing their failures;

• contamination of soil and water fracturing fluid is due to incorrect handling them more surface than the one determined by the injection of these fluids in shale gas formations etc.

These findings are somewhat confirmed by concerns in recent years to find technological solutions to stimulate compact formations bearing shale gas to reduce the drawbacks highlighted above.

Hydraulic fracturing technology is designed individually for each probe individually, taking into account the construction of the well, its depth, the nature of geological formation of cracks and of course, the purpose of the operation. The project envisages operation, mainly: the depth of the probe; Cased column diameter and wall thickness; the cement behind the columns cased depth and attachment thereof; initial bottom pressure and current; bottom temperature; composition of formation fluids / extracts; nature of the formation of cracks (type of minerals), mineralogical analysis, the nature of the cement, grametrometrică composition, porosity, permeability etc.

The practice of hydraulic fracturing / cracking hydraulic Romania in order to increase productivity wells exploiting deposits clustered in low permeability geologic formations (sandstones, marls / clays, sand, etc.), dates back over 40 years, during which they successfully executed hundreds of such operations.

3. FRACTURING PULSES (PULSES) CONTROLLED

American literature process is known as *Dynamic Pulse Loading* and *Controlled Pulse Fracturing* [7, 8].

Since unconventional gas deposits matrix porosity and permeability are very low, and the addition of artificial fracture proppant is used, obtaining good results with

this method depends on how the fractures created by the natural intercepts them.

Stimulating as such is the ignition of propellant charges in the right band followed by the development of productive pulses (pulses) high pressure. After ignition engine is subjected to controlled burning deflagration. Gas pulses generate a high-energy fractures the rock adjacent to protrude radially at a distance of 1.5 - 6 m [7].

4. THE "FAST FRACK" - HALLIBURTON [5]

To shorten the execution of hydraulic fracturing and reduce water consumption, horizontal wells dedicated Frack Rapid system uses a special assembly hydraulic bottom which allows the execution in one march up to 15 stages of fracture and subsequent selective in several sections of the hole. Water consumption is reduced by up to 40% and the duration of operations is reduced from weeks to days and from days to hours.

In hydraulic fracturing are a number of factors that determine the resulting geometry and therefore overall productivity of the system of fractures. Among them mention stress state of rocks under the reservoir, location preexisting planes of least resistance, etc. All of these are difficult to control during treatment. Contrary to the above, and in case of significant dimensions of the slots (tens of meters) which have a geometry and an orientation-controlled can ensure good conduction and natural fractures communication systems.

5. FRACTURING GELS BASED ON LIQUEFIED PETROLEUM GAS (LPG)

LPG gels prepared using three additives are used as fracturing fluids to avoid using water and prevent damage permeability gas-bearing shale rock in deposits compact clay and sandstone.

In the post treatment, LPG comes up in gaseous (propane) is recovered, cooled and liquefied and returned to the multiple fracture (multiple steps) to the same probe and other probes.

Environmental impact if this technology is lower than the water-based crosslinked gels because large operations are reduced due to reduced quantities of fluids used because full recovery fluid into the formation productive. No blocking effects on productivity rock system.

Currently, the horizontal drilling a combination of a hydraulic fracturing operation in several steps leading to a significant increase in the production of shale gas. In order to protect the environment, we can already think of alternatives such as cracking the methane gas, electric arc crack, cracking laser etc.

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