THE ROLE OF GREEK CHEMICAL ENGINEER IN FUTURE UPSTREAM ACTIVITIES IN GREECE

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ABSTRACT

Greece together with Cyprus is believed that will be the next big thing in the upstream sector of Eastern Mediterranean sea while there is no any school or department of petroleum and natural gas engineering. Apart from Metallurgical and Mining Engineering School in N.T.U.A and Resources Engineering in T.U.C, which are the most, close schools compared to their curriculum, chemical engineering schools can play vital role especially until the establishment of a new school of petroleum and natural gas engineering. In this paper, there is a presentation of the main divisions of petroleum engineer together with the applications in a reservoir field. There is a description of all the tasks that a chemical engineer can participate with the appropriate training in reservoir engineering, in Enhanced Oil Recovery operations and in conformance improvement in production and injection well. Furthermore, in production engineering applications can participate in handling flow assurance problems, in surface facilities, in field processing: of produced natural gas to prepare it for transportation and sale, of produced crude oil to prepare it for storage, transportation and sale and of produced water to prepare it for disposal or injection. Yet importantly, in drilling engineering applications chemical engineer can participate by measuring the composition and rheology of drilling fluids where represent the lifeblood of the well.

Keywords: Chemical Engineer, Greece, Petroleum Applications

INTRODUCTION

Greece is believed that will be the next big thing in the upstream sector of Eastern Mediterranean sea. Nowadays the only drilling activities in Greece is through Energean Oil and Gas in Prinos basin near Kavala in the North part of Greece. On the other hand, many big companies came and are ready to invest both in onshore and offshore areas. This means that in the near next years there will be need for petroleum and natural gas engineers. In Greece, there is no any school or department of petroleum and natural gas engineering. The two more close departments to petroleum and natural gas engineering studies are firstly the Metallurgical and Mining Engineering School in National Technical University of Athens (NTUA/Polytechnic of Athens) and the department of Resources Engineering in Technical University of Crete (TUC/Polytechnic of Crete). In Metallurgical and Mining engineering department in Athens, the courses that are taught and are familiar with petroleum and natural gas engineering studies are Petroleum Engineering, Drilling Engineering, Geostatistics (in many other petroleum engineering departments abroad this course can be found as Reservoir Characterization), Applied Geophysics and Geothermal Engineering. From these five courses, only the first two can be characterized as obligatory for petroleum and natural gas engineers since the other three in the majority of other petroleum engineering departments abroad are characterized as technical elective courses. On the other hand, in Resource Engineering department in TUC, the courses that are taught and are familiar with petroleum and natural gas engineering studies are Reservoir Engineering, Drilling Engineering, Applied Geophysics, Applied Geostatistics, Operation of Reservoirs (this course describes the outline of rock and fluid properties course that can be found in other curriculums in petroleum engineering departments such as USA

and Europe) and Geothermal Engineering. In undergraduate level in Greece, there are no other courses familiar with petroleum and natural gas engineering studies. This shows that the difference between these engineers from these two specific departments from NTUA and TUC compared with other engineers that can do a master in petroleum engineering is not big. It is obvious that other engineers can play important role in the developing upstream sector in Greece. These engineers must be Chemical Engineers due to the fact that have common courses with petroleum engineers (thermodynamics, transport phenomena, fluid dynamics, fluid properties, chemistry) compared to other engineers [1, 2, 3].

Applications of Petroleum and Natural Gas Engineers

The management of a reservoir field can be from Multidisciplinary Team Organization (MTO) where the Asset Manager has the responsibility of the work. Multidisciplinary team works together as a task force under the asset manager and all the members of the team share the same objective. The team members also share the same environment.

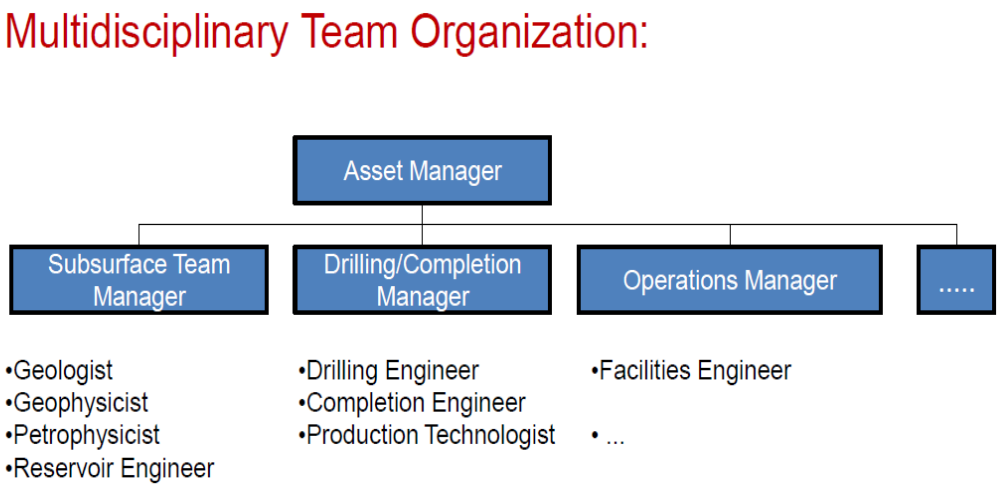

Figure 1 *Multidisciplinary Team Organization Chart* [4]

Integrated Reservoir Management Team does another way for management a reservoir field. In this organizational chart, teams are structured based on the specific needs of the reservoir system. The team structures and personnel will change in different phases.

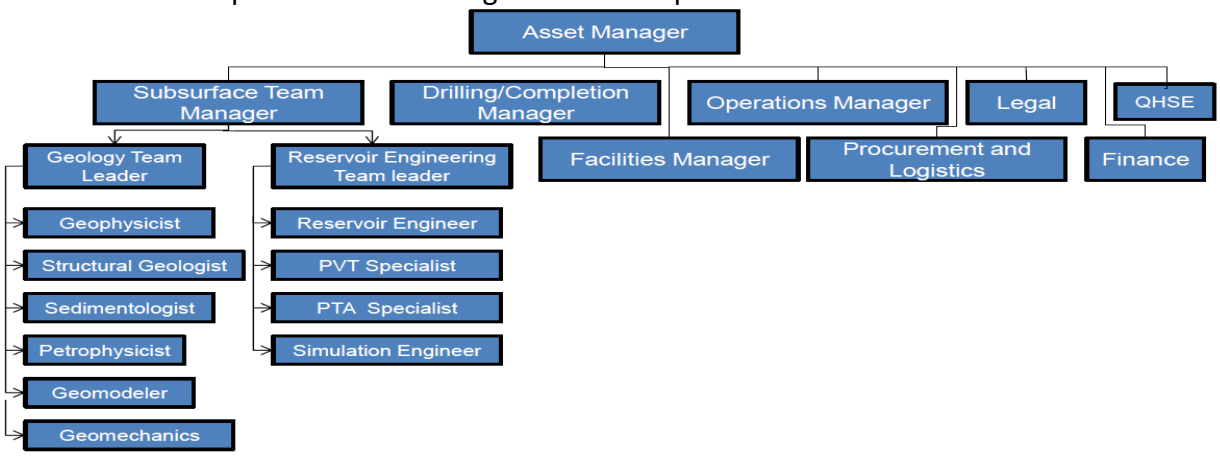

Figure 2 *Integrated Reservoir Management Team Organization Chart* [4]

The studies of petroleum engineers are divided to three main divisions. These divisions are Reservoir Engineering, Drilling Engineering and Production engineering. The role of reservoir engineer is to be responsible for the characterization of fluid flow in the reservoir. Work scope includes fluid data,

relative permeability data, and identification of recovery mechanisms, modelling, production scenarios, performance predictions and optimization of recovery by the application of water flooding and EOR methods. The role of drilling engineer is to be responsible
the design and drilling of wells based on the data acquisition and production strategy set in the development-planning phase. The role of production engineer is to be responsible for the flow of reservoir fluids from the near wellbore to the surface. The work scope includes improvement of well productivity with stimulation treatments, perforation and completion techniques, artificial lift methods, nodal analysis for determining bottlenecks in the system, and flow assurance issues [4, 5, 6, 7, 8, 9, 10, 11].

ROLE OF CHEMICAL ENGINEER IN RESERVOIR ENGINEERING APPLICATION

The role and the tasks of a chemical engineer in reservoir engineering field can be in Enhanced Oil Recovery (EOR) Operations such as Lab Studies, Numerical Modelling, Optimization, and Field Applications. Field applications can be Steam Flooding, Polymer Flooding, In Situ Combustion, CO_2 Flooding and Alkaline/Surfactant Flooding. In Steam Flooding, chemical engineer can participate in Conceptual design, procurement, installation, commissioning of equipment for steam generation facilities, lab studies, numerical modelling, and field application optimization. Chemical engineer in In Situ Combustion process can implement the last three tasks of steam flooding process. In Polymer Flooding process, chemical engineer can take part in lab studies, optimizing polymer concentration and slug size in field applications, constructing and operation of polymer plants for supplying polymer for floods. In alkaline/surfactant flooding, chemical engineer participates in lab studies, numerical modelling, optimizing alkaline/surfactant types, concentrations and slug sizes to optimize recovery. The second role of chemical engineer in reservoir engineering field can be in conformance improvement in production and injection well. In other words, chemical engineer can participate in lab tests, design, application and monitoring of chemical systems and technologies that improved conformance during oil recovery and water injection operations (such as organic polymers and or cross-linked polyacrylamide systems) [4,7].

ROLE OF CHEMICAL ENGINEER IN PRODUCTION ENGINEERING APPLICATIONS

The role of a chemical engineer in production engineering field is divided in seven different tasks. Firstly, chemical engineer is capable of handling flow assurance problems from the scope of prediction, diagnosis, prevention and removal of asphaltenes, emulsion, foaming, paraffin deposition, scaling, hydrate formation and corrosion. Figure 3 presents examples of flow assurance problems. Chemical engineer can also work in surface facilities such as conceptual design, sizing, procurement, installation, commissioning and operation optimization of separators (2 phase, 3 phase, horizontal, vertical), compressors, surface pumps(centrifugal pumps, multiplex positive displacement pumps, progressing cavity pumps), pipelines, Rate Measurement Systems (Coriolis, Vortex, Electromagnetic, Turbine, Positive Displacement and Ultrasonic Flowmeters) and storage tanks [9].

Figure 3 *Examples of Flow Assurance problems* [9]

Another service that a chemical engineer can offer in production engineering field is the field processing of produced natural gas to prepare it for transportation and sale such as conceptual design, procurement, installation, commissioning of equipment for, and operation optimization of cleaning by removing liquids, "Sweetening", or treating, by removal of acidic gases (H_2S and/or CO_2) and dehydrating by removing water vapour and controlling H_2O dew point. Furthermore, chemical engineer can participate in field processing of produced crude oil to prepare it for storage, transportation or sale by the operations of conceptual design, procurement, installation, commissioning of equipment for, and operation optimization of separating the crude oil from any entrained solids, emulsified water or brine and stabilizing the crude oil by removing dissolved gas so that it is safe to be transported and stored. Another field process that a chemical engineer is familiar with is field processing of produced water to prepare it for disposal/injection by the tasks of conceptual design, procurement, installation, commissioning of equipment for, and operation optimization of processes such as filtration, cyclonic separation, flotation and evaporation [3, 8]. The last two tasks of a chemical engineer in production engineering field are the acid diverting agents by design and application of chemical agents used in stimulation treatments to ensure uniform injection over the area to be treated and the hydraulic fracturing fluids by measuring their composition, their rheological properties and by their safe disposal of produced ones [4, 9, 10].

ROLE OF CHEMICAL ENGINEER IN DRILLING ENGINEERING APPLICATIONS

Chemical engineer can work with safety in measuring the composition and rheology of drilling muds (fluids). Success in drilling operation depends significantly on the performance of drilling fluids circulating down the drill string through the drill bit and up to annulus. Modern drilling fluids playing a vital role in drilling oil and gas wells and can be characterised as the ''lifeblood'' of the well [11, 12]. Another important task that a chemical engineer can participate is cement selection (as cement engineer). This task is very crucial, because if there is any leakage or damage in either primary or secondary cementing operation, the process for correction is very costly since you need to start to whole process of drilling from the beginning (drilling-casing-cementing).

CONCLUSION

The upstream sector in Greece, it is obvious that will increase in the next few years. This make the establishment of real school of petroleum & natural gas engineering a necessity. Chemical engineers with a master or PhD in petroleum and natural gas engineering field will play an important role until this establishment. Especially as production engineer in flow assurance issues and as drilling

engineer (either mud engineer or cement engineer), chemical engineers can work with great success in both onshore and offshore fields.

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