

## Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Lyudmila Khakimova

**PhD Program:** Petroleum Engineering

**Title of Thesis:** New approached for numerical modeling of air-injection based enhanced oil recovery

**Supervisor:** Associate Professor Alexey Cheremisin

### Name of the Reviewer:

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

**Signature:**



**Date: 15-11-2020**

*The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.*

*If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.*

### Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

Ms. Lyudmila KHAKIMOVA's thesis entitled, "New Approaches for Numerical Modeling of Air Injection Based Enhanced Oil Recovery," is generally well-written and acceptable with very minor editorial changes. The thesis research project is aimed at attempting the development and implementation of novel approach and methodologies in the modeling/numerical simulation of the *in situ* combustion processes using the actual experimental data from laboratory *in situ* combustion related experiments, including the combustion tube (CT) and Ramped-Temperature Oxidation (RTO) and the Pressurized Differential Scanning Calorimeter (PDSC) tests and then examine process performance in order to match the laboratory experimental results.

The thesis consists of the well-balanced combination of relevant background, fundamentals and application of novel approaches to the modelling and numerical simulation for the *in situ* combustion processes using actual experimental data. The simulation results show consistent and reasonable match of the temperature profiles, and the process performance, in general. It also highlights the complexities associated with the simulation of these highly complex processes and the need for the appropriate reaction kinetics data in order to match the product gas compositions. The use of fundamental thermodynamics to address and overcome the challenges in the reaction kinetics modelling is remarkable.

It is clear that Lyudmila has carried out a lot of original work which provides significant insights into the complexities of the various processes associated with numerical simulation of the complex and interrelated oxidation and combustion processes, including heat and mass transfers, associated in-situ combustion-based enhanced oil recovery processes. I believe that she has made a good use of the existing literature. Her thesis, with minor editorial corrections, will be an excellent reference resource for future studies and applications.

Ms. Lyudmila Khakimova's thesis certainly satisfies the thesis requirements of her PhD program. Ms. Khakimova has certainly demonstrated her capabilities of performing research work of high caliber. Presented PhD Thesis may be considered as complete qualification for a PhD candidate.

#### Provisional Recommendation

☒ I recommend that the candidate should defend the thesis by means of a formal thesis defense

☐ I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

☐ The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense