



Monitoring technological processes at TANEKO oil refinery with Kaspersky MLAD



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Oil & Gas Industry

- Industry: oil refining
- Location: Nizhnekamsk, Republic of Tatarstan, Russia
- TATNEFT group
- Most important facility: CDU-VDU-7
- CDU: crude distillation unit
- VDU: vacuum distillation unit
- Kaspersky Machine Learning for Anomaly Detection (MLAD) used at CDU-VDU-7

- Kaspersky MLAD – software solution for detecting and interpreting anomalies in technological processes utilizing machine learning
- Ability to detect anomalies, regardless of the nature of the attack or system failure

JSC TANECO

JSC TANECO is a modern company operating in the Russian petroleum refining industry. As part of the PJSC Tatneft group it plays an important role in the economy of Tatarstan.

The Facility and the Problem

The strategic goal of TANECO is the production of high-quality products in a continuous technological loop.

The number of industrial processes at the oil refining and petrochemical plant is enormous, and this is the source of numerous risks. The most complex and important unit of the plant is CDU-VDU-7, which includes the electric desalting system where crude oil arrives, the furnaces, and the atmospheric and vacuum columns where oil products are distilled into different fractions. The processes here are sensitive to input feedstock, the correct functioning of the cooling system, and the operating temperature ranges. Under these conditions, receiving information about any deviations in technical processes in automatic mode is critically important.

For this reason, TANECO has chosen CDU-VDU-7 to pilot a novel Kaspersky Lab product – MLAD (Machine Learning for Anomaly Detection) – which analyzes the telemetry of the plant’s technological processes using machine learning.

Expert Opinion

“We have been successfully cooperating with Kaspersky Lab for many years to protect the company’s office network. We are also jointly implementing a pilot project for the maintenance of the industrial information security system for the rail gasoil discharge terminal. We need a comprehensive approach. That’s why, in addition to the information security systems to ensure the safety of technological processes, we are planning to use MLAD.

“The chosen solution allowed us to significantly increase transparency of the processes on the most important CDU-VDU-7 unit and to detect any deviations in automatic mode without resorting to a huge number of written rules and constraints. Early detection enables operators to prevent dangerous situations from escalating, regardless of the cause: be it a configuration error, hardware failure or hacker attack,” says Marat Kharisov, head of the Automatic Process Control System (APCS) division at TANECO.



Kaspersky MLAD:

- Training on CDU-VDU-7 process telemetry for the period April 2017 – February 2018
- Additional training with new data
- Online monitoring of process anomalies
- Early automatic detection of anomalies in technological processes
- Automatic interpretation of anomalies
- Intuitive interface

The Solution

In 2017, based on the historical data from the CDU-VDU-7 facility, a neural network model for detecting anomalies in the technological processes of these units was built and trained. The model was capable of additional learning with new incoming data.

The pilot MLAD version containing this model was launched in February 2018 in real-time mode to monitor technological processes and included automatic detection of process deviations from their normal behavior.



The example above demonstrates a detected anomaly in the temperature of the vacuum distillation column packing. In this case, analysis showed that the anomaly was caused by an incorrect flowmeter measurement due to impulse tubes being blocked by coke deposits.





Results

During the period from April 2017 to May 2018, various types of anomalies were detected:

- Deviations in the technological process related to changes in the plant's operating regimes;
- Change-over of facility control loops to manual mode;
- Situations related to incorrect sensor measurements.

The information security specialists at TANECO were provided with a tool for the automatic early warning of potentially dangerous situations.

The process technologists were provided with a tool for the automatic early detection of anomalies and their interpretation, as well as an intuitive interface showing trends in process values and analyses of deviations.



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