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STUDY OF NATURAL RADIONUCLIDES IN GAS CONDENSATE AND CALIBRATION OF RADIOISOTOPIC LEVEL GAUGES

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In the JV Uz-Kor Gas Chemical LLC (Kungrad, Karakalpakstan) uses Berthold Co.Ltd (Germany) radioisotope level gauges for to measure the level of liquid gas condensate in process tanks, which are installed on tanks in 12 positions on the accumulation and processing of gas condensate. By technological regulations, in the regular (normal) mode of operation of the radioisotope level gauge, when the process tank is completely filled with liquid gas condensate, the radioisotope level gauge should show "full filling"on the displays of the electronics unit. However, when a closed container is completely filled with liquid gas condensate, the radioisotope level gauge was showed "empty", i.e. the radioisotope level gauge does not was worked, it was impossible to calibrate of radioisotope level gauge and observed increase in the gamma background.

The purpose of the study is radiation monitoring of natural radionuclides at various facilities and technological equipment of a gas production enterprise, conducting gamma spectrometric analysis of natural radionuclides in formation waters, gas condensate, intermediate technological products, finished products, as well as developing a method for accurate calibration of radioisotope level meters and achieving proper operation radioisotope devices in normal online mode.

The results of the monitoring by using dosimetric devices Radiogem 2000, Target IdentiFinder R400, radiometers SRP-68-01 and SRP-88 N with a detection units showed that in wells, in liquid gas condensate, formation waters and process equipment, there is an excess of the permissible control level of gamma radiation exposure dose rate by 40 times, which is associated with the accumulation of natural radionuclides in process tanks and gas condensate processing equipment. The results of gamma spectrometric analysis using a DSA-1000 multichannel analyzer with a Ge detector and Genie-2000 software and a Radek MKGB-01 gamma-beta spectrometer showed that in contaminated soils draining formation waters the parent radionuclides 226Ra has a specific activity of ⊠22000 Bq/kg, and 232Th has a specific activity of ⊠7420 Bq/kg. The results of gamma spectrometric analysis of various samples of liquid gas condensate, formation waters and technological products of gas condensate processing showed that the content of short-lived natural radionuclides of 228Ac, 224Ra, 212Pb, 212Bi and 214Pb, 214Bi have total activity of more than 100 Bq/kg. Studies have shown that after the technological process of filtration and separation of liquid gas condensate from formation waters, natural radionuclides in the composition of gas condensate are repeatedly reduced. However, small concentrations of short-lived natural radionuclides contained in liquid gas condensate gradually accumulate in the process tank along with the gas condensate and therefore they negatively affect the operation of radioisotope level meters in the process of measuring the level of liquid gas condensate and technological products in closed tanks. It was also established that after 15 days in the gas condensate, the short-lived radionuclides 214Pb (T1/2=26.8 min), 214Bi (T1/2=20 min), 228Ac (T1/2=6.1 hours), 224Ra (T1/2=3,6 days), 212Pb (T1/2=10.6 hours), 212Bi (T1/2=61 min) completely disintegrate and the powdery bulk intermediate product contains traces of these radionuclides, therefore after this period the gas condensate can be processed according to the production process to obtain the final finished products (granules of polypropylene and polyethylene), which does not contain natural radionuclides.

To solve the problem of calibrating a radioisotope level gauge an increase of activity of the Cs-137 ionizing radiation source by 1.5 times when replacing a source with an activity of 70 mCi with a more powerful source with an activity of >100 mCi did not give any positive result and the calibration of the radioisotope densitometer was not achieved. To solve these problems 2 methods have been proposed: Method No. 1: On the surface of the wall of the technological tank in front of the detector, a protective screen was installed from a lead plate ⊠ 17 mm thick, 1500 mm long and 100 mm wide, which was serves fully to absorb additional gamma radiation from natural radionuclides; Method No. 2: For normal operation of the radioisotope level gauge, a signal current correction unit was developed, the function of which is to eliminate (suppress) gamma radiation from natural radionuclides. The operating principle circuit of the signal current correction unit was borrowed from circuit the compensation ionization chamber (compensation neutron chamber), which is used for measuring the neutron flux of the WWR-SM nuclear reactor in presence gamma radiation in the reactor core.

Based on the research carried out, in the JV Uz-Kor Gazokhimik LLC took urgent measures to minimize the environmental risks of gamma irradiation of personnel and ensured sanitary standards of radioecological safety.

In particular, in areas with high levels of gamma radiation, radiation hazard signs were installed and restrictions were introduced on the access of enterprise personnel to radiation-hazardous containers and equipment. Currently, gamma spectrometric measurements of the studied samples of gas condensate, formation waters and finished technological products are carried out quarterly in the JV Uz-Kor Gazokhimik LLC.

Section

Radiation ecology and methods of analysis (Section 3)

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