

Technetium (Tc) is a chemical element belonging to 7th group of the periodic table (transition metal). Primarily, Tc is obtained artificially by fission processes of heavy nuclei, but it is also present in Earth's crust due to spontaneous fission in uranium and thorium ores. There are 32 radioactive isotopes and 11 metastable isomers of technetium known at this moment.

One of the isotopes of technetium, namely ^{99m}Tc , is frequently used in nuclear medicine, especially in diagnostics with Single-Photon Emission Computed Tomography (SPECT) imaging technique. Physicochemical properties such as low gamma-rays energy (140.5 keV, P = 99%), short half-live time equal 6.01 h and rich coordination chemistry contributes to common utilization of ^{99m}Tc in wide range of diagnostic tests. It is estimated that in near future almost 80% of examinations in nuclear medicine will be conducted by means of ^{99m}Tc .

Ventilation – perfusion lung scan is one of medical imaging methods in which ^{99m}Tc is applied. This examination consists of two lung scans. First part, perfusion scan, allows to asses lungs blood supply and requires intravenous injection of technetium macro aggregated albumin containing 150 MBq of ^{99m}Tc . In order to examine patency of bronchial tree and lungs, pulmonary ventilation scan is performed. Before scanning, gas containing 400 MBq of ^{99m}Tc is inhaled by patient through mouthpiece or mask covering nose and mouth. In medical routine, technetium DTPA or Technegas (ultrafine dispersion of ^{99m}Tc labeled carbon) are used as a source of radionuclide. During inhalation of gaseous radioactive technetium, part of ^{99m}Tc activity may leak into room air and pose an additional risk of radiation burden for medical staff who perform examinations.

It is very important to provide safe work environment for nuclear medicine staff. Unfortunately, as previous studies have shown, there is a serious problem with uncontrolled internal absorptions of ^{99m}Tc by a nuclear medicine medical personnel.

Currently, at Polish nuclear medicine units only the staff exposure to external radiation is monitored. Measurements by thermoluminescent dosimeters, however, will not provide any information on the doses due to radio-iodine incorporated into the body. Therefore, the radiological safety standards applied at present fail to meet the requirements of the so-called conservative assessment rule, where upper dose limits should be estimated. With internal dose estimation for the incorporated technetium entirely ignored, the assessed doses tend to be underestimated, and the doses due to the radionuclides absorbed into the body remain undetermined. Therefore, periodic and systematic monitoring of the internal contamination should be integrated into radiological protection standards for teams dealing with highly radioactive ^{99m}Tc .