*Table 1*

The main statistical parameters of the total HM and mobile forms of HM in the soils of the JSC "Mogilev plant of artificial fiber" site.

| Indices | Cd | | Zn | |
|---|---|---|---|---|
| | total | mobile | total | mobile |
| Minimum value, mg / kg | 0.12 | 0.07 | 21.7 | 3.1 |
| Maximum value, mg / kg | 0.15 | 0.12 | 127.6 | 23.7 |
| Average for a sample, mg/kg | 0.14 | 0.09 | 82.7 | 14.2 |
| Values above the MCL / APC [1], % | – | – | 75 | – |
| Maximum multiplicity of MCL/APC exceeding | – | – | 2.3 | – |
| Mogilev region local background value | 0.33 | – | 18.9 | – |
| Average value in Mogilev | 0.51 | – | 45.8 | – |

The average total cadmium in the soils of the JSC "Mogilev plant of artificial fiber" site is 3.6 times lower than the APC. Mobile cadmium in the soil samples does not exceed the MCL.

The occurrence of total zinc in concentrations exceeding the MCL is found out accounting for 75 %. The average concentration of total zinc exceeds 1.5 times the APC.

It is stated that total zinc in the soils of the JSC "Mogilev plant of artificial fiber" site has decreased 1.3 times recently. The PAH content in the soils observed does not exceed the established standards in comparison with previous years of observations, when this value was 1.3 times higher than the APC.

Local soil monitoring found out that almost all soils in the controlled area undergo chemical contamination. The main soil pollutants of the "Mogilev plant of artificial fiber" site are zinc, cadmium, and PAH.

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# POSITRON EMISSION TOMOGRAPHY VISUALIZATION PROCESS

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The purpose of a positron emission tomography for visualizing the anatomy of a body is presented. The principle of a PET examination, the principle of detecting photons, and a PET scanner setup is described.

*Keywords*: positron emission tomography, PET/CT scanners, nuclear medicine, PET department, medical imaging, radiopharmaceuticals, positron annihilation, line-of-response (LOR), field of view, BGO, LSO.

A positron emission tomography (PET) is a non-invasive nuclear imaging technology that involves administration of a radiopharmaceutical labeled with a positron emitting radionuclide to a patient and subsequent visualization of the distribution and kinetics of this radioactive substance in a patient's body. A positron emission tomography is based on the detection of the temporal coincidence of two 511 keV photons produced during annihilation of a positron and scattering in opposite directions. Temporal coincidence of photons within the selected interval is recorded by special tomography electronics. Since the directions of scattering annihilating photons are in a straight line, an additional collimation is not required to limit the system's field of view.

Currently, a PET is often combined with a computer x-ray tomography (CT) in one device. Such a system (PET / CT) represents a fundamentally new visualization modality. It combines the gantry of both modalities into a single whole, which allows a linear movement of a patient from one apparatus into another. Data collection occurs in a close time sequence and joint registration. The motivation for this approach comes from the need to identify areas of increased absorption of the radio tracer in relation to an individual anatomy of a patient. By increased radiopharmaceutical assimilation PET scanning only reveals the abnormality of tissue functions, rather than provides information on tissue morphology.

The PET imaging process begins with the injection of a radiopharmaceutical labeled with a positron-emitting radionuclide into a patient. Positrons are formed during the decay of neutron-deficient nuclei. Positronium is unstable and decays through annihilation which results in the emission of two 0.511 MeV photons in opposite directions. If the kinetic energy of the positron is close to zero, then two 511-keV annihilation photons scatter isotropically strictly at the angle of 180º to each other.

In a positron emission tomography, two 511-keV annihilation photons are detected within each other's coincidence window by two opposite detectors along a straight line called a line-of-response. In full ring systems data is collected simultaneously within 360º.

In modern PET scanners, BGO and LSO crystals are installed. These crystals are not hygroscopic, and therefore they do not require hermetic packaging. Both detectors have high density and a linear attenuation coefficient.

In a PET scanner, each detector is connected in a coincidence chain to a series of opposing detectors. The number of opposing elements can vary from one to a maximum equal to a half of the total number of detectors located on the ring. Therefore, each detector element can be connected to coincide with a maximum of a half the total number of opposite elements. Each detector element has a number of projections, depending on the number of opposite detectors connected to it. The angle of "coincidence" of the detector element formed in this case is called an acceptance angle. The multiple acceptance angles of all detectors on the scanner ring create a transaxial field of view.

The purpose of this work is to describe the main stages of the process of visualizing the internal structures of a body when performing positron emission tomography and to determine the basic principles for registering photons with detector elements of a PET scanner.


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## CHARACTERISTICS TO BE MONITORED ON PET/CT


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The characteristics to be monitored on X-ray computed tomographs, positron emission tomographs, and on a positron emission tomography apparatus combined with an X-ray computed tomography are listed to ensure the correct operation of the apparatus.



*Keywords:* positron emission tomography, computed tomography, PET/CT scanners, quality of PET / CT images, quality assurance program, radiation safety, dosimetric characteristics, characteristics of the scanner.


The following groups of characteristics are tested on x-ray computed tomographs:
- radiation safety system;
- electromechanical characteristics of the scanner;
- image quality;
- dosimetric characteristics.

Radiation safety system.

The following devices incorporated into X-ray computed tomographs are monitored for radiation safety:
- information boards and signal lights;
- loud speaker communication;
- emergency radiation switches.

Electromechanical characteristics of a scanner.

The following electromechanical characteristics of X-ray computed tomographs are checked:
- light localization system;
- table incrementation accuracy.

Image quality.

The following image quality parameters of X-ray computed tomographs are checked:
- CT number, uniformity and noise in a homogeneous environment;
- spatial resolution and contrast resolution;
- slice thickness and distance measurements.