Institute of Nuclear Physics
Academy of Sciences of Uzbekistan

Development of Nuclear Technologies in the Institute of Nuclear Physics Uzbekistan Academy of Sciences

Ilkham SADIKOV[1]
Toshikazu HOSODA[2]

1) Director Institute of Nuclear Physics, Uzbekistan
2) Chairman and CEO, Chiyoda Technol Co., Japan

Mito - 2025

Satellite map of INP

Territory: total – 314 ha; scientific -industrial zone - 44 ha

Basic Nuclear Physical Fasylities

Cyclotron U-150-II

22 MeV Protons

Electron Accelerator

8 MeV Electrons

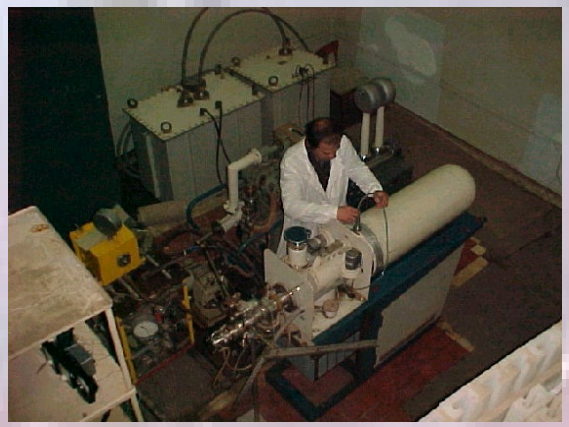
Reactor WWR-SM

Reactor power – 10 MW
Neutron flux– $1 \cdot 10^{14}$ ·n/см^2·s

Gamma Facility

Co-60 120 kCi

Neutron Generator



14 MeV Neutrons
$1 \cdot 10^{10}$ ·n/см^2·s

Cooperation with the IAEA

Modernization of reactor power supply systems

=48 V и =110 V

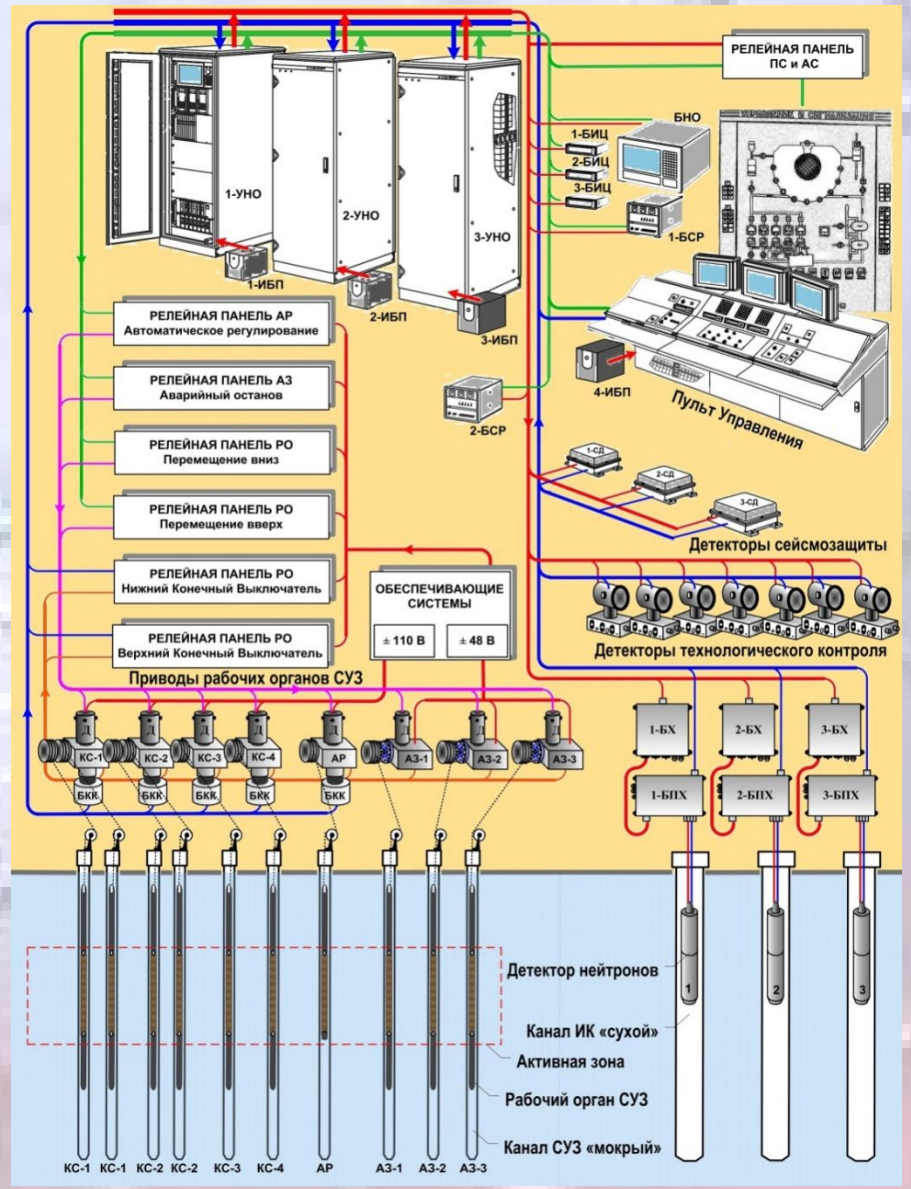
UPS-80kW

UPS-160kW

Alternating current switchboard

transformers and 40 kW diesel generator

Modernization of the control and protection system



Cooperation with the IAEA

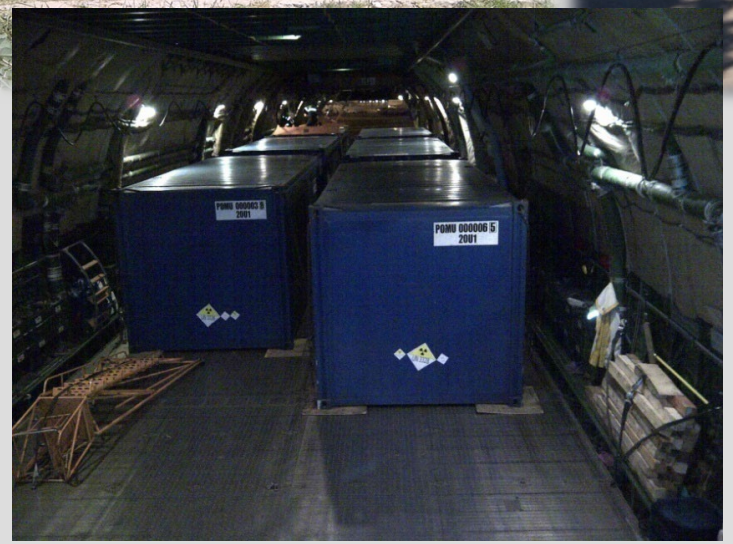
Modernization of the Radiation Monitoring System

Modernization of the 2-circuit cooling system

Cooperation with the IAEA

Modernization of the reactor control panel

Shipment of spent nuclear fuel



Developed of the Production Technologies

More than 60 types of pharmaceutical products are produced, including about 20 ready-to-use radiopharmaceuticals

Reactor radionuclides:

P-32, P-33, S-35, Cr-51, Mn-54, Fe-55, Fe-59, Co-58, Co-60, Mo-99, Y-90, I-125, I-131, Pm-147, Sm-153, Ho-166, Lu-177, Ta-182, W-188, Ir-192, Au-198, Hg-203

Cyclotron radionuclides:

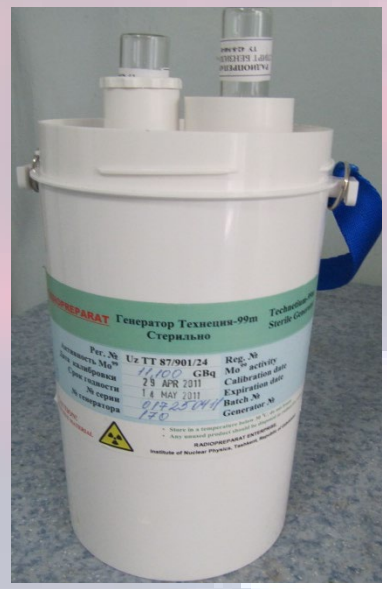
Co-57, Zn-65, Ga-67, Ge-68, Pd-103, Ce-139

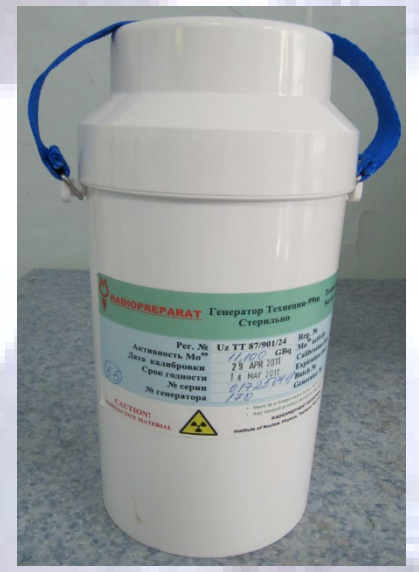
Radionuclide generators:

Ge-68 → Ga-68, Mo-99 → Tc-99m,
Sn-113 → In-113m, W-188 → Re-188

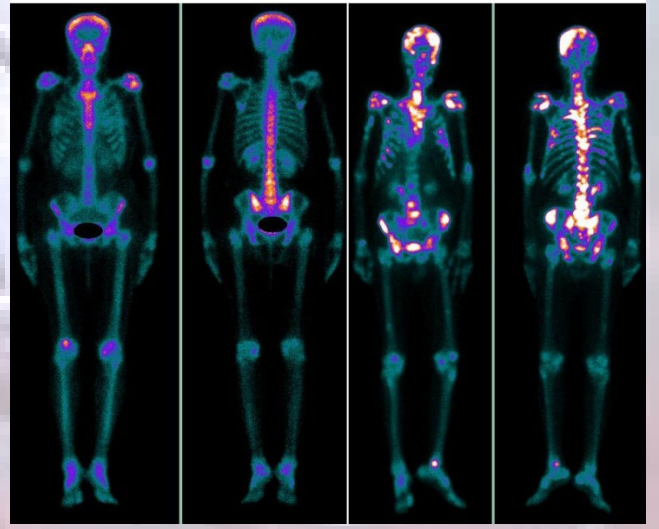
- Radioisotope products, the production of which is established at the INP AS RUz;
- Radioisotopes, the production technology of which has been developed at the INP RUz, but production has not been established

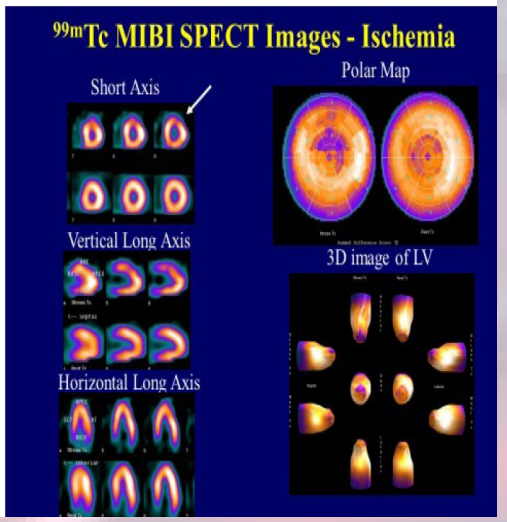
Generator Tc-99m





Generator Nominal Activity:
18.5 GBq / 0.5 Curie
11.1 GBq / 0.3 Curie
7.4 GBq / 0.2 Curie
5.5 GBq / 0.15 Curie
Radiochemical purity- not lees that- 99.0%
Radionuclide impurities:
Mo-99 - no more than-0.01%





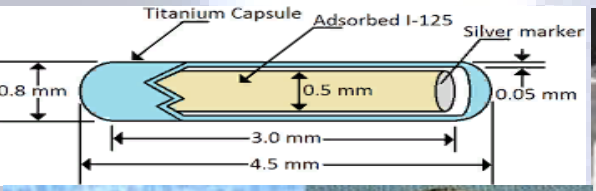
Iodine-125

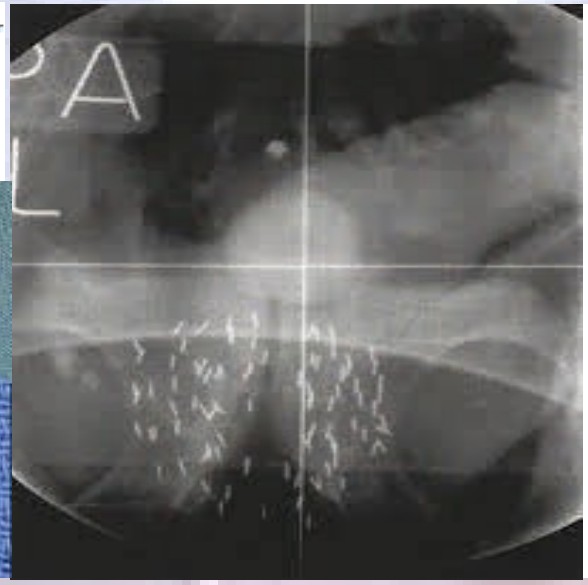
Specification of the substance «Solution of sodium iodide with Iodine-125, carrier free»:

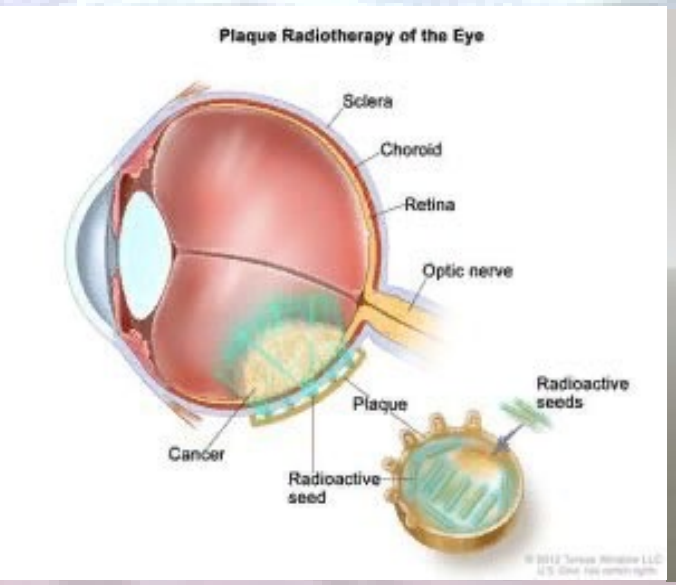
- Radioactive concentration – 150-1500 mCi/ml
- Specific Activity– not less than-17,2 Ci/mg
- Radiochemical Purity - not less than - 99,0%
-Concentration of Iodine-126,- no more than- 1 $x10^{-6}$ %

Up to 3000 Curies are produced each year.

The production capacity allows the volume to be increased by 2-2.5 times.



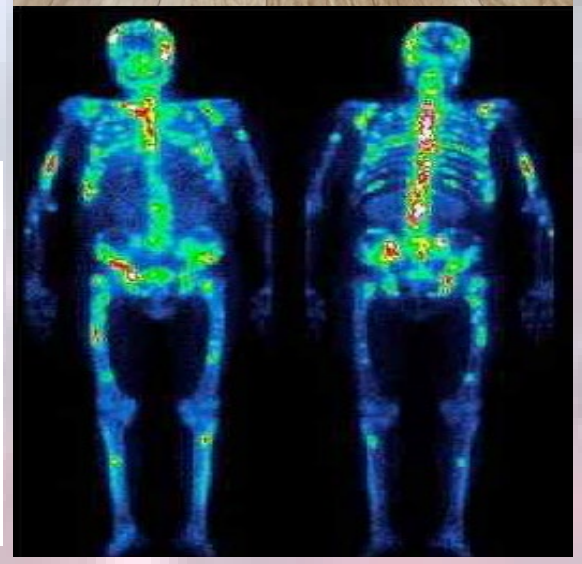




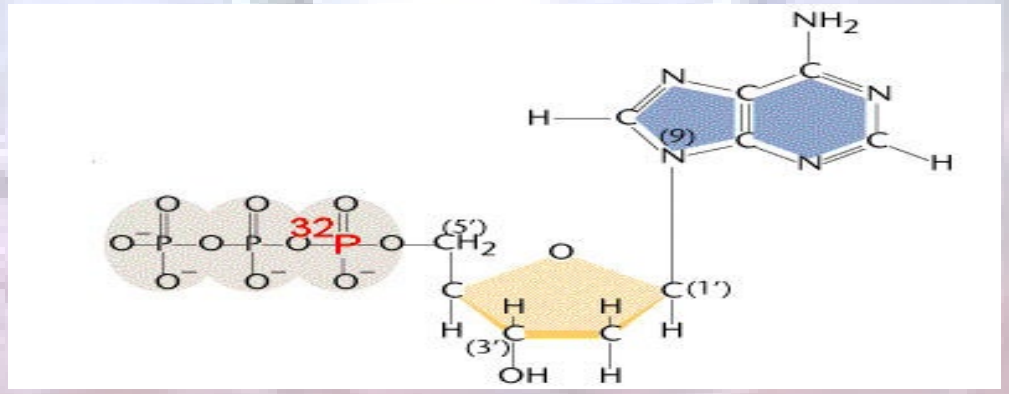
Phosphorus-32

Specification of the substance « Ortophosphoric acid labeled phosphorus-32, in water solution » :

- Radioactive concentration – 100-2000 mCi/ml
- Specific Activity– not less than- 8500-9000 Ci/mmol
- Radiochemical Purity - not less than - 99,0%
- Radionuclide admixtures P-33, % - no more than - 0,01 %



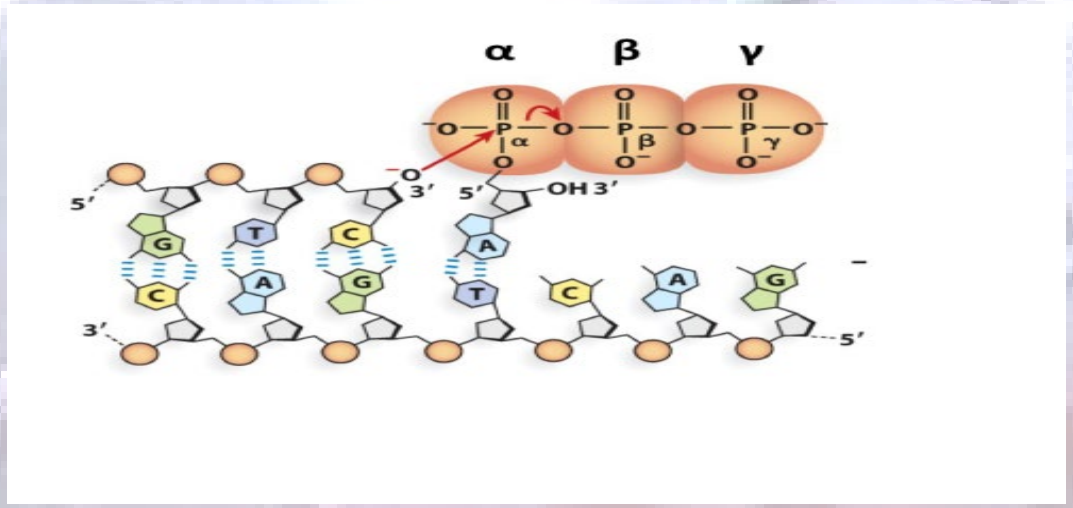
Radiopharmaceutical based on the radionuclide phosphorus-32: Sodium phosphate dibasic, labeled with phosphorus-32, for injection



Phosphorus-33

Specification of the substance « Ortophosphoric acid labeled PHOSPHORUS-33, carrier free» in 0,04 M HCl solution:

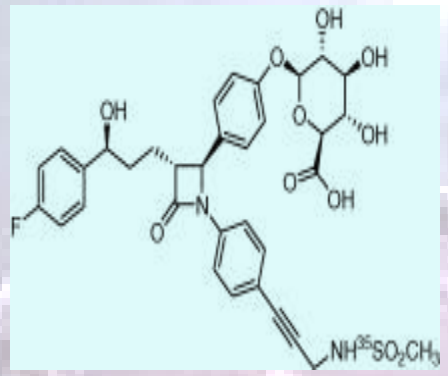
- **Radioactive concentration – 100-2000 mCi/ml**
- **Specific Activity– not less than- not less than -4560 Ci/mmol**
- **Radiochemical Purity - not less than - 99,0%**
- **Radionuclide admixtures P-32, % - no more than - 0,01 %**

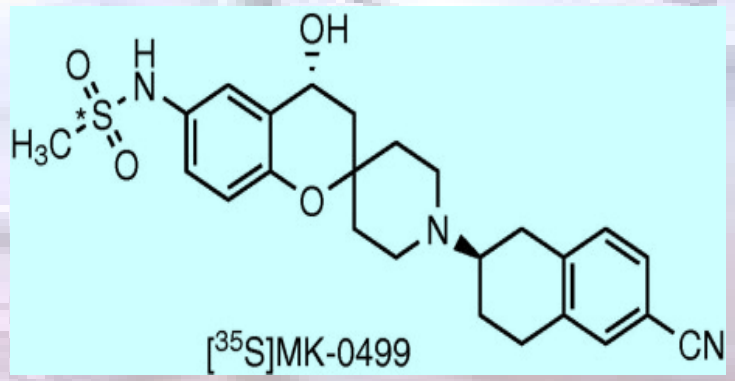


Sulfur-35

Specification of the substance « Sulfuric acid, labeled S-35, carrier free» in water solution:

- Radioactive concentration – 6000 mCi/ml
- Specific Activity– not less than-1400-1500 Ci/mmol
- Radiochemical Purity - not less than - 99,0%
- Radionuclide admixtures P-32, K-42, % - no more than - 0,01 %





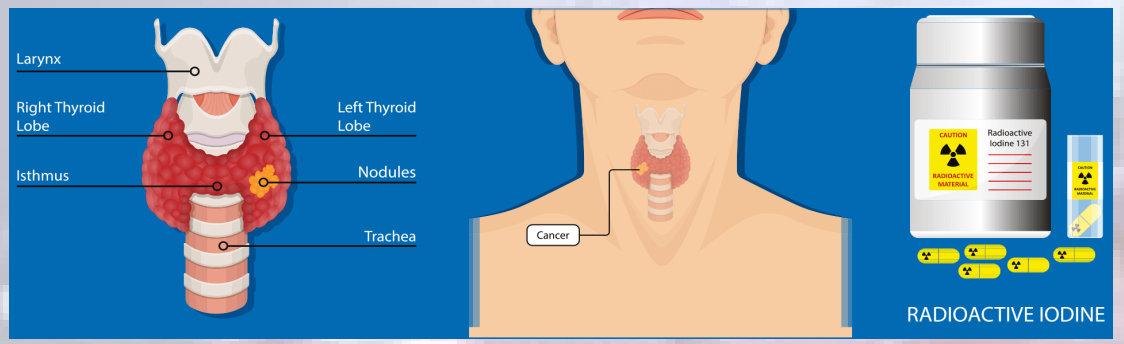
Iodine-131

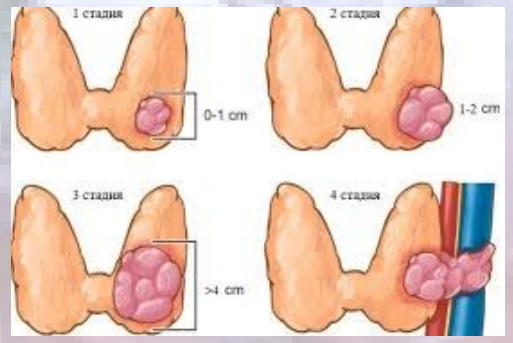
Specification of the substance «Solution of sodium iodide with Iodine-131, carrier free» :

- **Radioactive concentration – 1000-10000 mCi/ml**
- **Specific Activity– not less than- 600 Ci/mmol**
- **Radiochemical Purity - not less than - 97,0%**
- **radionuclide purity - more than 99.99%**

Radiopharmaceuticals based on the radionuclide iodine-131: - -- Sodium iodide labeled with iodine-131, in isotonic solution, for injection

- **Rose Bengal labeled with iodine-131, for injection**
- **Sodium o-iodohippurate labeled with iodine-131, for injection**
- **Sodium iodide labeled with iodine-131, in capsules, for oral use**
- **Meta iodine benzylguanidine labeled with iodine-131, for injection**





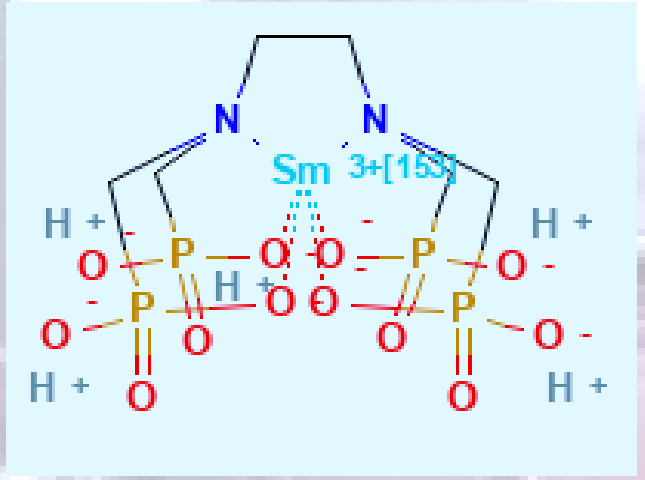
Samarium-153

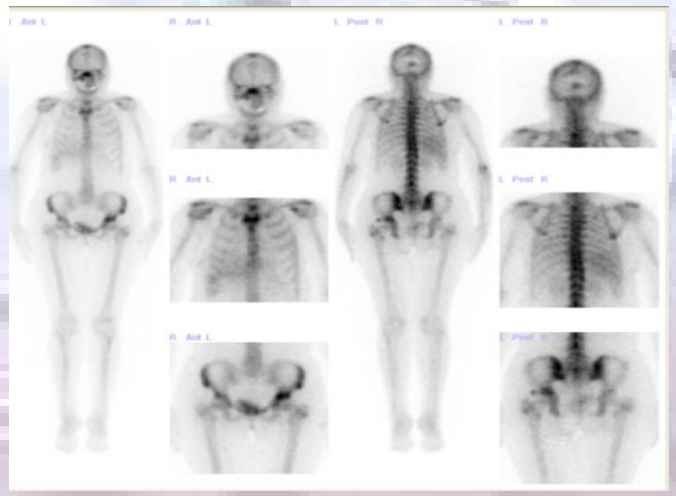
Specification of the substance «Samarium chloride with ^{153}Sm» in 0,04 M HCl solution:

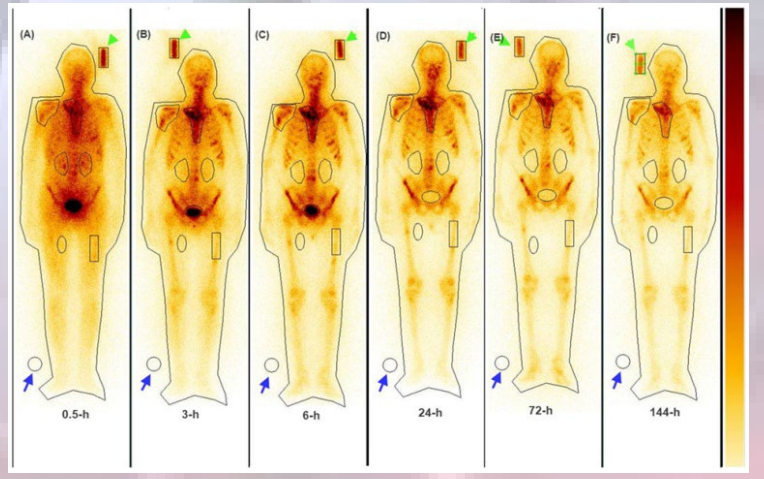
- Radioactive concentration – 240 – 1500 mCi/ml
- Radiochemical Purity - not less than - 99,0%
- Radionuclide impurities,% -no more than- $3 \cdot 10^{-3}$ %

Radiopharmaceutical based on the radionuclide Samarium-153:

- **«Samarium, ^{153}Sm Oxabifor» for the treatment of bone metastases**







Lutetium-177

Specification of the substance ««Lutetium chloride ($^{177}LuCl_3$) with ^{177}Lu carrier free» in 0,04M HCl :

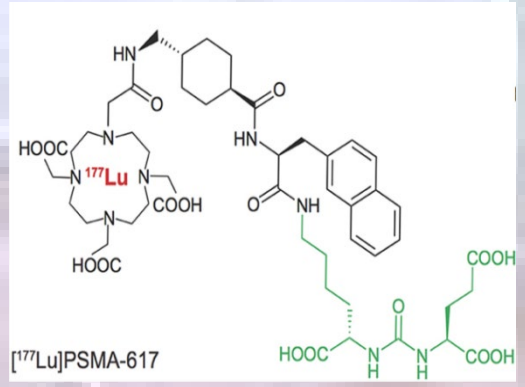
- **Radioactive concentration – 300 -3000 mCi/ml**
- **Radiochemical purity - not lees than- 99,0%**
- **Specific activity- not lees than- 92,0 Ci/mg**
- **Inactive impurities:**

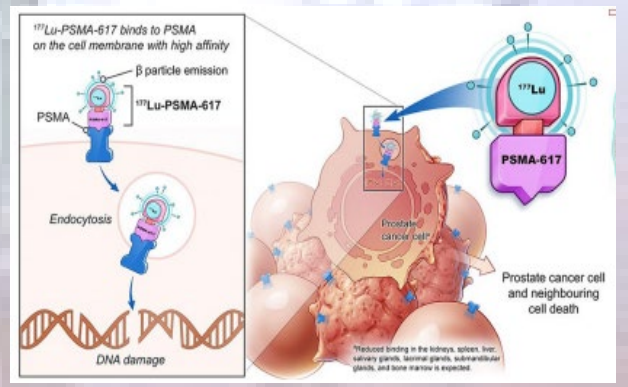
Fe ≤ 0,25 μr/GBq < 0,08; Cu ≤ 0,5 μr/GBq < 0,007; Zn ≤ 0,5 μr/GBq < 0,064; Pb ≤ 0,5 μr/GBq < 0,032

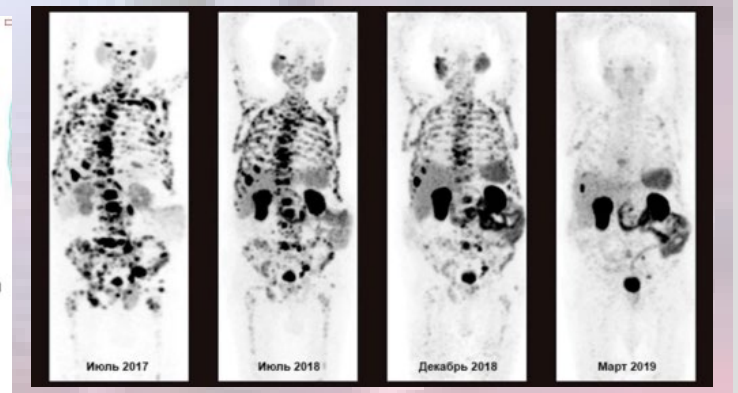
- **Up to 400 curies are produced each year.**
- **The production capacity allows the volume to be increased by 2-2.5 times**

- **Radiopharmaceutical based on the radionuclide Lutetium-177:**

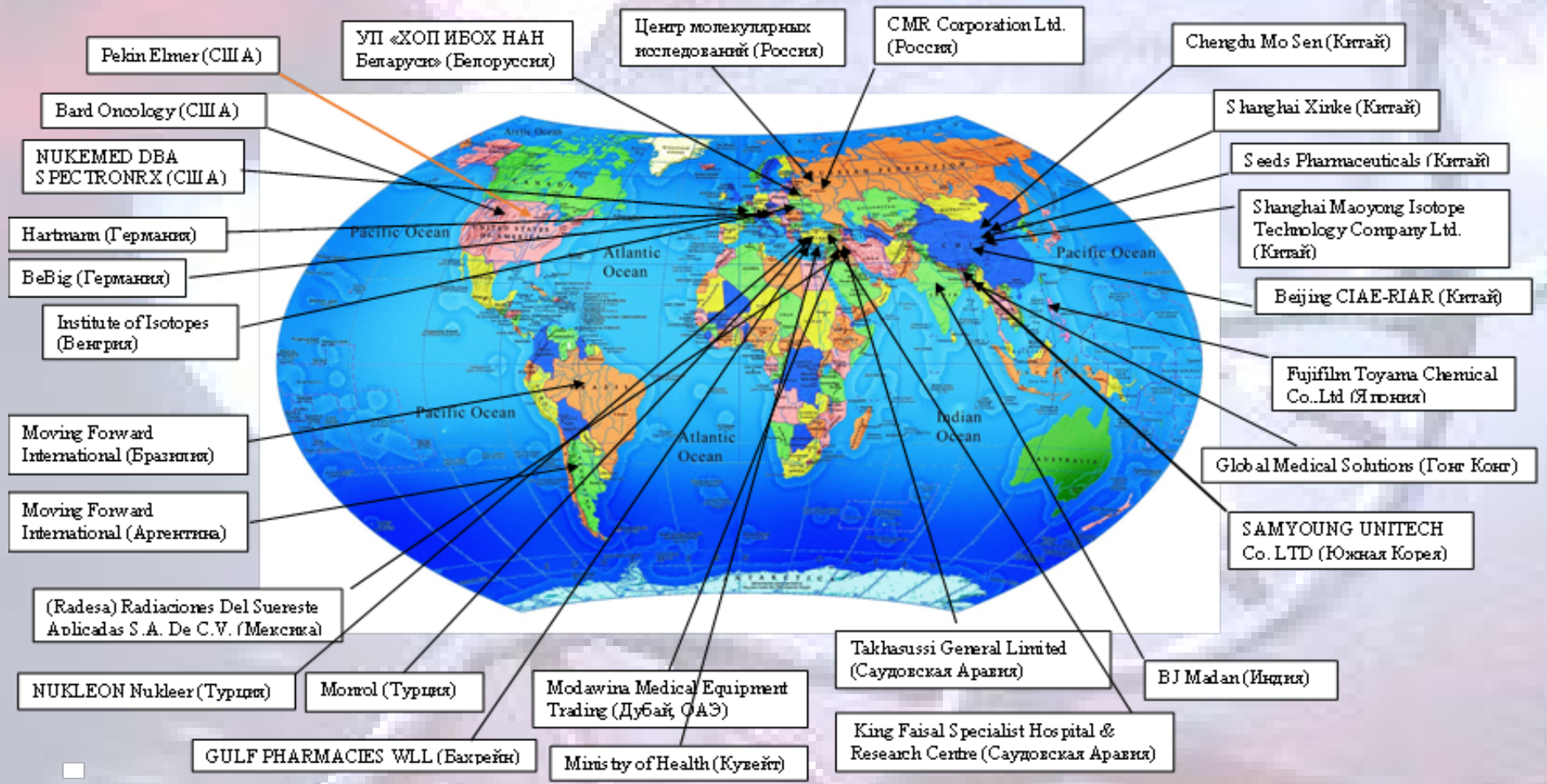
-Lutetium-177-PSMA-617 for the treatment of metastatic prostate cancer





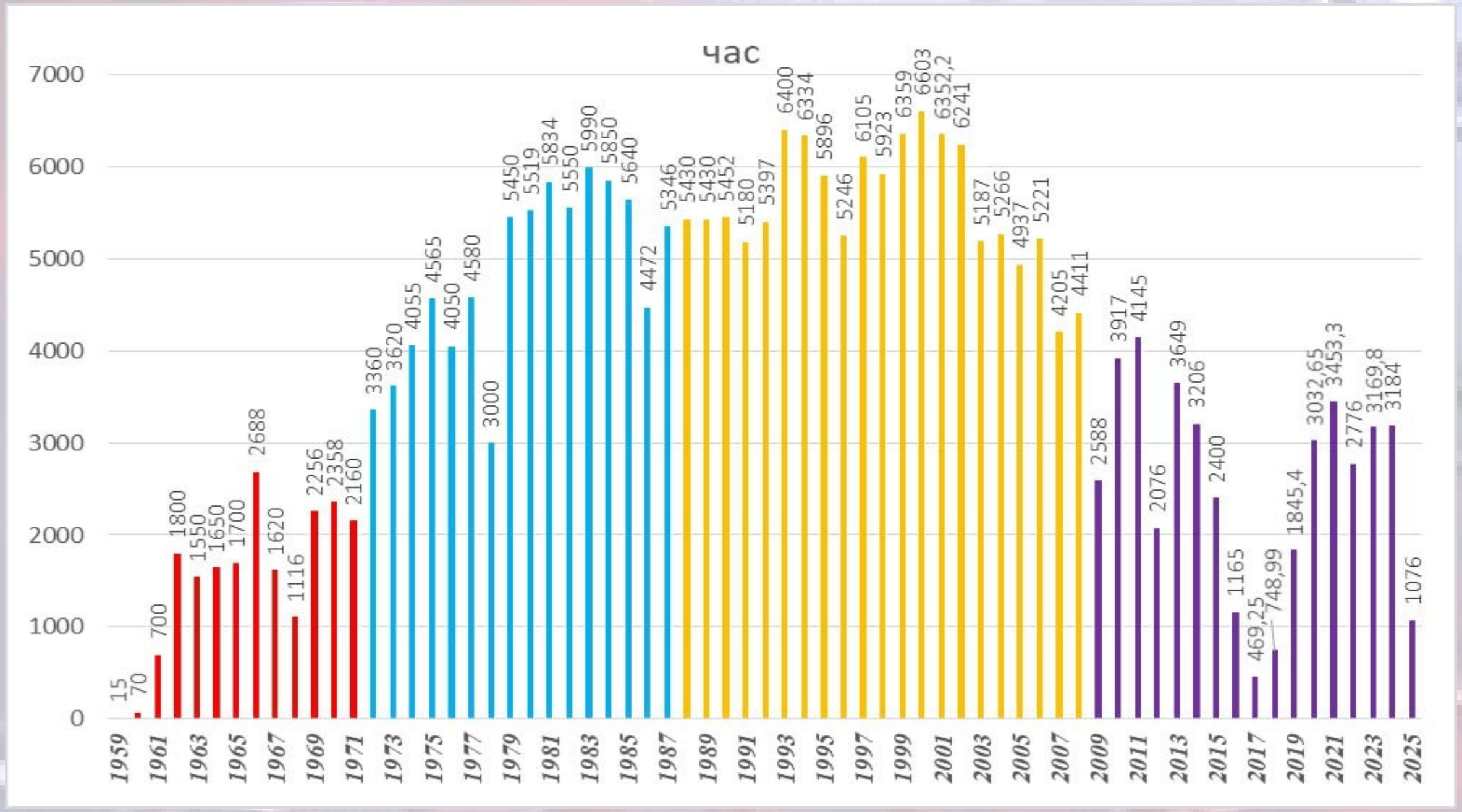


Export of Radioisotope Production



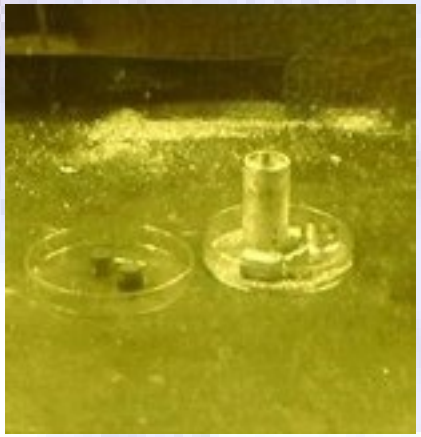
Products	2024
Radiopharmaceuticals	4,52
Cobalt-57	1,04
Colorization of topazes	0,42
Total	5,98

Operation time of the reactor



Cooperation with Chiyoda Technol Corporation

- Joint research on the production of Molybdenum-99;
- Signing of a Memorandum of Understanding on cooperation;
- Cooperation on the development of technology for obtaining Actinium-225;
- Realization of a contract to determine the concentration of radium-226 in uranium industry waste.



Perspective

Radioisotopes for general purposes and radiopharmaceuticals	Development of technologies for obtaining of the radionuclide Terbium-161
	Development of a technology for the production of radiopharmaceuticals based on the radionuclide Lu-177 with ethylenediamine tetramethylene phosphonic acid (EDTMP) for the treatment of early bone metastases with pain syndrome
Cold kit for technetium-99m generator	Tc-99m-Nanotech (based on albumin nanoparticles) for scintigraphy of the lymphatic system to confirm its integrity and differential diagnosis of venous and lymphatic obstruction.
Producing of the Cyclotron Radioisotopes	Installation of a new cyclotron with an energy of 30 MeV and production of cyclotron radionuclides such as F-18, Co-57, Cu-63, Ge-68, Pd-103 and I-123
Construction of a new research reactor with a capacity of 20-30 MW	Expanding the capabilities of nuclear technology. Increase in the number of produced radionuclides and increase of production volume up to 5 times.

Thank you for attention!