# THE FIRST STAGE OF THE USSR ATOMIC PROJECT AND URANIUM ENRICHMENT IN THE URALS

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> "…Probably more than any other group in the Project, the group working on gaseous diffusion deserves credit for courage and perseverance, as well as for scientific and technical talent…"
>
> *G. D. Smith*

The quote from Henry Smith, the author of the report on the Manhattan Project [1], emphasizes the complexity of the task of separating uranium isotopes. Smith singles it out from the huge number of difficult problems solved in the creation of atomic weapons. The work [2] highlights the contribution of employees of scientific and educational institutions of the city of Yekaterinburg to the first stage of the Atomic Project of the USSR. This contribution is little known, mainly due to the transfer of those recruited to the Atomic Project to work in such specially created institutions as Laboratory No. 2 of the USSR Academy of Sciences, the Ural Electrochemical Plant (Novouralsk), KB-11 (RFNC – VNIIEF) in Sarov. The main part of the work is devoted to the description of how the most difficult task facing the developers of the USSR atomic shield was solved – the industrial separation of uranium isotopes. Thus, in Sverdlovsk in 1943, under the leadership of I. K. Kikoin, the first work on isotope separation using diffusion and centrifugation methods began. I. K. Kikoin was appointed deputy of I. V. Kurchatov and was the main person responsible for the development of an industrial method for obtaining uranium-235.

The report consists of the following parts:

1. The beginning of the Atomic Project.
2. Determination of possible separation methods. First studies on Lange centrifuge.
3. Help from Soviet intelligence.
4. Beginning of work on Atomic project in Sverdlovsk.
5. Porous filters.
6. Transfer of work from Sverdlovsk to Moscow.
7. Reviewer's question.
8. Ural Electrochemical Plant.
9. Trip to Berlin in May 1945.
10. Second landing of Sverdlovsk scientists to Atomic project.
11. First diffusion plant D-1.
12. Centrifuge technology of uranium enrichment.
13. Development of methods of registration of nuclear explosions.
14. Employees of phase transformation laboratory of Institute of metal physics.
15. Scientists chemists.
16. Instead of epilogue.

For development of diffusion method of separation of uranium isotopes on December 6, 1951 "leading managers of work on separation of uranium isotopes by diffusion method" became laureates of Stalin Prize of the first degree. An even more difficult task was to obtain uranium by centrifugation: if the creation of diffusion machines could rely on developments in the USA and Great Britain, then the development of the centrifuge separation method was several decades ahead of the world nuclear industry. The importance of the transition to a new separation method can be characterized by two facts. Fact 1. The World Nuclear Association claims [3] that at the height of the Cold War, three gaseous diffusion plants in the USA consumed 7% of the electricity produced in the USA during the period of greatest capacity. Fact 2. The experimental centrifuge plant of the Ural Electrochemical Plant in 1958 "reached the design mode and showed that with this method, energy consumption per unit of separation is reduced by at least twenty times (!) compared to the gaseous diffusion method of separating uranium isotopes (p. 10 [4]).

The work was carried out within the framework of the state assignment of the Ministry of Education and Science of Russia for the IPM UB RAS.

## References

1. **Smith, G. D.** Atomic Energy for Military Purposes: Official Report on the Development of the Atomic Bomb under the Supervision of the US Government [Text]. – M. : Transzheldorizdat, 1946.
2. **Gudin, S. A.** Employees of the Institute of Metal Physics of the Ural Branch of the Russian Academy of Sciences and the Formation of the USSR Atomic Project [Text] // Uspekhi fizicheskikh nauk. – 2024. – Vol. 194. – No. 7. – P. 765–789. – doi: https://doi.org/10.3367/UFNr.2024.02.039648
3. https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/uranium-enrichment.aspx
4. **Emelyanenkov, A. F.** Solo on a Centrifuge [Text]. – M. : ANO "Information Center of the Nuclear Industry", 2013. – 28 p.