

Global Promethium-149 Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Promethium-149 market size is expected to reach \$ 26.09 million by 2032, rising at a market growth of 7.4% CAGR during the forecast period (2026-2032).

In 2025, global Promethium-149 production was approximately 34 grams, with a global average market price of around \$415,000 per gram. That year, total global production capacity for Promethium-149 reached 120 grams, and the industry's average gross profit margin stood at 34%. Promethium-149 (Pm-149) is an artificial radioactive isotope of the rare-earth element promethium; it has an atomic number of 61 and a mass number of 149, classifying it as a lanthanide radionuclide. Promethium has no stable isotopes; all its isotopes are radioactive. While Promethium-147 is the most mature in terms of industrial application, Promethium-149—due to its relatively short half-life (approximately 53 hours)—exists primarily as a nuclear fission product and a short-lived intermediate nuclide in nuclear reaction studies. Promethium-149 is mainly produced via the fission of Uranium-235 or Plutonium-239, though it can also be synthesized artificially through nuclear reactions; it primarily undergoes beta-minus (??) decay to form stable Samarium-149 (^{149}Sm).

The upstream segment of the Promethium-149 industry chain encompasses nuclear fuel systems, research reactors, high-flux neutron sources, accelerator facilities, target materials, and radiochemical processing equipment. As a fission product, Promethium-149 is primarily generated within fission product chains during the fission of Uranium-235 or Plutonium-239. Consequently, various rare-earth fission products—including Promethium-149—are produced during nuclear reactor operations, spent fuel reprocessing, or high-flux irradiation experiments. Beyond the fission route, research institutions can also produce promethium isotopes for nuclear data and radiochemical research by subjecting rare-earth targets (such as neodymium or

samarium) to neutron capture or charged-particle reactions. Core upstream capabilities center on controlling high-flux irradiation conditions, separating fission products, employing rare-earth element separation technologies, and managing radioactive liquid waste. Due to its short half-life, Promethium-149 production must typically align with nuclear facility operating cycles, making it difficult to maintain long-term stockpiles as is done with long-lived isotopes. The midstream segment of the industry chain comprises national laboratories, nuclear fuel reprocessing facilities, isotope research centers, and radiochemical experimental platforms, which are responsible for isolating and purifying Promethium-149 from complex fission product mixtures. As fission products contain a mixture of radionuclides—such as neodymium, samarium, cesium, strontium, and ruthenium—Promethium-149 (Pm-149) requires separation via techniques like ion exchange, extraction chromatography, and solvent extraction, with its radionuclidic purity verified through gamma-ray spectrometry, beta-ray spectrometry, and mass spectrometry. Key midstream technical challenges include enhancing the efficiency of selective Promethium separation, mitigating interference from isotopic impurities (such as Samarium-149), ensuring radiochemical purity, and enabling the analysis of micro-scale samples. Compared to Promethium-147, Promethium-149 has a shorter half-life; consequently, it is typically produced for immediate use rather than for long-term inventory and sale. Downstream applications primarily involve nuclear physics research institutes, nuclear energy R&D organizations, reactor design agencies, and radiochemistry laboratories. As a characteristic fission product, data regarding the formation patterns, decay characteristics, and yields of Pm-149 are vital for nuclear fuel cycle analysis, reactor neutronics calculations, and the study of fission product behavior. Researchers utilize Pm-149 to investigate fission product distribution, beta decay processes, the refinement of nuclear databases, and the migration behavior of fission nuclides in spent nuclear fuel. Furthermore, since the decay of Pm-149 produces stable Samarium-149 (Sm-149)—an isotope with a high neutron absorption cross-section—the Pm-149/Sm-149 decay chain is also relevant to reactor poison analysis, burnup calculations, and core physics research. Unlike Promethium-147, which finds application in nuclear batteries, thickness gauging, and specialized light sources, Promethium-149 is primarily a research-oriented radionuclide; future demand will remain concentrated in areas such as nuclear data measurement, advanced reactor R&D, nuclear fuel cycle optimization, and fundamental radiochemical research.

The demand for advanced nuclear energy research and fission product analysis is the primary driver behind the development of Promethium-149 (Pm-149). As a typical fission product generated during the fission of nuclear fuels such as Uranium-235 and Plutonium-239, Pm-149—along with its yield, decay behavior, and decay relationship

with Samarium-149—holds significant importance for reactor physics calculations, burnup analysis, and nuclear fuel cycle research. With the advancement of advanced nuclear reactors, small modular reactors (SMRs), fast reactors, and closed fuel cycle technologies, research institutions require more precise fission product databases to optimize core design, improve fuel utilization efficiency, and assess long-term operational safety. Nuclear data related to Pm-149 (such as fission yields, beta-decay parameters, and nuclear reaction cross-sections) help refine nuclear databases and improve simulation accuracy for new reactor types; consequently, scientific demand for this isotope is expected to remain stable.

Advances in nuclear data measurement and radiochemistry techniques are opening up new avenues for research and application involving Pm-149. Since Promethium has no stable isotopes, Pm-149 has long been a key subject for studying the separation of rare-earth fission products, beta-decay processes, and the chemical behavior of lanthanides. Developments in high-resolution gamma-ray spectroscopy, mass spectrometry, and automated radiochemical separation systems enable researchers to detect and isolate trace amounts of Pm-149 with greater precision, thereby advancing technologies in nuclear fuel reprocessing, fission product migration studies, and radioactive waste management. Furthermore, the growing need to understand the long-term evolution of fission products within advanced nuclear fuel cycle systems will drive further research into short-lived fission nuclides, including Pm-149.

On the supply side, the development model will continue to be characterized by "small-batch production and on-demand supply." Unlike isotopes with long-term utility such as Pm-147, Pm-149 has a half-life of only about 53 hours, making large-scale stockpiling impossible; its production relies heavily on the operating cycles of research reactors, nuclear fuel reprocessing facilities, and radiochemical separation capabilities. The future supply system will not evolve into a model of standardized commodity production; instead, it will increasingly adopt an approach characterized by "production at nuclear facilities, separation in laboratories, and supply via research projects." Key areas for technological upgrading in the industry include the design of high-throughput irradiation targets, automated fission product separation, recovery of trace amounts of promethium, high-sensitivity radionuclide detection, and radioactive waste minimization, all aimed at enhancing radionuclide utilization efficiency per unit of reactor operating time.

Report Scope

This report studies the global Promethium-149 production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Promethium-149 and provides market size (US\$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of Promethium-149 that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Promethium-149 total production and demand, 2021-2032, (Gram)

Global Promethium-149 total production value, 2021-2032, (USD Million)

Global Promethium-149 production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (Gram), (based on production site)

Global Promethium-149 consumption by region & country, CAGR, 2021-2032 & (Gram)

U.S. VS China: Promethium-149 domestic production, consumption, key domestic manufacturers and share

Global Promethium-149 production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Gram)

Global Promethium-149 production by Type, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

Global Promethium-149 production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Gram)

This report profiles key players in the global Promethium-149 market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include ORNL, Rosatom, CIAE, Curium, etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Promethium-149 market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US\$ Millions), volume (production, consumption) & (Gram) and average price (US\$/g) by manufacturer, by Type, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Promethium-149 Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Market Segmentation

Global Promethium-149 Market, Segmentation by Type:

Global Promethium-149 Supply, Demand and Key Producers, 2026-2032

Neutron Irradiation Production

Accelerator Production

Global Promethium-149 Market, Segmentation by Product Form:

Promethium-149 Radioactive Solution

Promethium-149 Target Material

Promethium-149 Compounds

Global Promethium-149 Market, Segmentation by Activity Level:

Low Activity

Moderate Activity

High Activity

Global Promethium-149 Market, Segmentation by Purity Grade:

Nuclear Physics Research Grade

Medical Isotope Research Grade

Metrological Standard Grade

Global Promethium-149 Market, Segmentation by Application:

Nuclear Medicine

Industrial Tracer

Scientific Research

Companies Profiled:

ORNL

Rosatom

CIAE

Curium

Key Questions Answered

1. How big is the global Promethium-149 market?
2. What is the demand of the global Promethium-149 market?
3. What is the year over year growth of the global Promethium-149 market?
4. What is the total value of the global Promethium-149 market?
5. Who are the Major Players in the global Promethium-149 market?
6. What are the growth factors driving the market demand?

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