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Spent Fuel and Nuclear Waste Management Market – Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Type (Low-level Waste, Intermediate-level Waste, High-level Waste), By Application (Nuclear Fuel Cycle, Research, Medical & Industrial Source, Military & Defense Programs, Other), By Region & Competition, 2020-2030F

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Abstracts

Market Overview

Global Spent Fuel and Nuclear Waste Management Market was valued at USD 5.1 billion in 2024 and is expected to reach USD 5.9 billion by 2030 with a CAGR of 2.2% through 2030. The global spent fuel and nuclear waste management market is primarily driven by the increasing demand for nuclear energy as countries seek to decarbonize their power sectors. This rise in nuclear power generation has led to a growing volume of radioactive waste, necessitating effective management solutions. Stringent regulatory frameworks from bodies like the IAEA and national governments are pushing operators to invest in advanced, compliant waste treatment and storage technologies. Technological advancements—such as vitrification, dry cask storage, and deep geological repositories—are enhancing safety and long-term sustainability.

Additionally, the development of small modular reactors (SMRs) and reprocessing techniques is helping reduce waste volumes while improving energy recovery. Environmental concerns and public scrutiny have also intensified, prompting authorities to adopt transparent, socially acceptable waste management practices. Countries like Finland and France are leading with permanent disposal solutions, which is encouraging broader global investment in infrastructure. Furthermore, the accumulation

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of high-level waste in temporary storage facilities is driving urgency for permanent solutions. International collaboration for shared facilities and knowledge exchange is also seen as a growing opportunity to reduce costs and improve safety. Together, these factors are propelling the market forward, making nuclear waste management a key pillar of sustainable nuclear energy development.

Key Market Drivers

Rising Nuclear Power Generation and Accumulation of Spent Fuel

One of the most significant drivers of the global spent fuel and nuclear waste management market is the increasing reliance on nuclear energy as a low-carbon alternative to fossil fuels. As countries strive to meet climate goals under international agreements such as the Paris Accord, nuclear power is being embraced for its ability to provide large-scale, stable baseload electricity with minimal greenhouse gas emissions. Consequently, the number of nuclear reactors is growing globally, especially in emerging economies like China, India, and Russia. Developed nations such as the U.S., France, and the UK are also extending the life of existing nuclear plants.

This rise in nuclear power generation directly correlates with the increased production of high-level radioactive waste, particularly spent nuclear fuel. Most existing reactors use once-through fuel cycles, where spent fuel is removed and stored after a single use. As of now, tens of thousands of metric tons of spent fuel are stored in interim facilities worldwide, many of which were not designed for long-term storage. This growing volume of radioactive waste poses serious environmental and safety risks, driving demand for advanced and permanent solutions like deep geological repositories, reprocessing technologies, and enhanced dry cask storage systems.

Furthermore, the backlog of waste from decades of nuclear energy production has created an urgent need for sustainable waste management infrastructure. This pressure is compounded by public opposition to temporary on-site storage and the looming decommissioning of older nuclear facilities. Governments and private stakeholders are therefore investing heavily in research, development, and deployment of long-term disposal solutions, fueling market growth. In summary, the expansion of nuclear energy and the ongoing accumulation of spent fuel are creating both a necessity and an opportunity for innovation and investment in nuclear waste management globally. Global nuclear power capacity is projected to grow by over 30% by 2050, as countries seek low-carbon energy alternatives. As of the mid-2020s, there are over 440 operational nuclear reactors worldwide, with more than 60 reactors under construction.

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Nuclear energy currently supplies about 10% of the world's electricity, with ambitions to increase that share in several regions. Small Modular Reactors (SMRs) are expected to represent 20% to 25% of new nuclear installations by 2040 due to their flexibility and lower upfront cost. Many countries aim to triple nuclear capacity by 2050 as part of their long-term net-zero strategies.

Key Market Challenges

High Costs of Infrastructure Development and Long-Term Disposal Solutions

A significant challenge facing the global spent fuel and nuclear waste management market is the enormous cost involved in developing safe, long-term disposal infrastructure. Establishing permanent repositories, such as deep geological disposal facilities, involves decades of planning, billions of dollars in investment, and extensive safety testing and approvals. These projects require advanced engineering, long-term monitoring systems, and careful environmental impact assessments, all of which substantially increase total expenditures.

Additionally, interim storage—using methods like dry cask or pool storage—requires constant upgrades and security measures to comply with evolving regulations. Many nuclear facilities were designed with short-term waste handling in mind and now face retrofitting costs to extend storage capabilities. In developing countries or regions with limited budgets, this cost barrier is especially prohibitive, slowing the implementation of advanced solutions.

Moreover, funding such projects often becomes politically contentious. Governments must balance energy security and environmental safety with taxpayer burden and public opinion. Many large-scale projects, such as the proposed Yucca Mountain repository in the U.S., have been stalled or canceled due to political opposition and cost concerns despite heavy investment.

Private companies may also hesitate to invest in such long-term, high-risk ventures without clear policy direction or financial incentives. This lack of financial clarity and long-term commitment from governments and stakeholders hampers market expansion and technology deployment. Furthermore, decommissioning old nuclear plants adds to the cost burden, as handling legacy waste and dismantling contaminated infrastructure requires substantial capital.

Key Market Trends

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Increasing Focus on Deep Geological Repositories for Permanent Disposal

A prominent trend in the global spent fuel and nuclear waste management market is the growing focus on deep geological repositories (DGRs) as a long-term, permanent solution for high-level radioactive waste. With interim storage methods such as pools and dry casks nearing capacity, governments and nuclear agencies are increasingly prioritizing the development of underground repositories that can isolate radioactive waste for thousands of years.

Finland is leading the way with the Onkalo deep geological repository, which is expected to be the world's first operational DGR. France's Cig?o project and Sweden's approved plans for their Forsmark site further demonstrate a strong push in Europe toward permanent underground storage. These projects follow strict international safety standards and are engineered to prevent any leakage into the biosphere over extremely long timescales.

This trend is being driven by public demand for safe, long-term solutions and by regulatory mandates requiring the identification and development of permanent disposal methods. In addition to meeting environmental and safety goals, DGRs help resolve political and legal debates around interim storage extensions and community objections to surface-level facilities.

As more countries begin exploring DGR options, there is an increase in cross-border collaboration, research funding, and private-sector involvement. For instance, countries with smaller nuclear programs are considering shared international repositories. Innovations in geological modeling, monitoring systems, and corrosion-resistant canisters are enhancing the feasibility and safety of these repositories.

Key Market Players

Orano SA

Westinghouse Electric Company LLC

Holtec International

Veolia Environnement S.A.

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Bechtel Corporation

Waste Control Specialists LLC

Babcock International Group PLC

Rosatom State Atomic Energy Corporation

Report Scope:

In this report, the Global Spent Fuel and Nuclear Waste Management Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Spent Fuel and Nuclear Waste Management Market, By Type:

Low-level Waste

Intermediate-level Waste

High-level Waste

Spent Fuel and Nuclear Waste Management Market, By Application:

Nuclear Fuel Cycle

Research

Medical & Industrial Source

Military & Defense Programs

Other

Spent Fuel and Nuclear Waste Management Market, By Region:

North America

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United States

Canada

Mexico

Europe

Germany

France

United Kingdom

Italy

Spain

Asia Pacific

China

India

Japan

South Korea

Australia

South America

Brazil

Colombia

Argentina

Middle East & Africa

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Saudi Arabia

UAE

South Africa

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Spent Fuel and Nuclear Waste Management Market.

Available Customizations:

Global Spent Fuel and Nuclear Waste Management Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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