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#6-62 Development of the Uranium Verification System for Nuclear Material Management in Korea

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The international community has consistently prioritized the peaceful application of nuclear energy, establishing a framework of safeguard agreements with the International Atomic Energy Agency to monitor and verify nuclear materials globally. A cornerstone of these efforts is uranium verification, a critical process designed to ensure that nuclear materials are not diverted for non-peaceful purposes. Among various verification techniques, Non-Destructive Analysis has become widely adopted due to its efficiency and capability for on-site material analysis without causing damage. Gamma spectrometry, a prominent Non-Destructive Analysis method, is particularly effective in assessing uranium enrichment levels, facilitating timely evaluations across different settings. However, despite these advantages, the accuracy of Non-Destructive Analysis in uranium verification can vary due to factors such as detector performance, environmental conditions, and sample characteristics, all of which impact the outcome. This variability highlights the necessity of a uranium enrichment analysis system that accounts for such influencing factors, thereby improving verification accuracy and reliability. In response to these challenges, this study focuses on developing a uranium verification system optimized for domestic applications, adhering to the uranium verification methodologies established by the IAEA. The primary aim is to enhance the precision and reliability of uranium verification in Korean, thereby contributing to a more secure and transparent nuclear material management framework. To achieve this, the study carefully examines the International Atomic Energy Agency's uranium verification techniques, paying particular attention to the unique environmental conditions associated with verification targets in Korea, such as uranium pellets, fuel rods, and UF6 cylinders. Based on these insights, the research proposes a customized uranium verification approach tailored to meet the specific requirements of the national environment. Future research will focus on developing this proposed system into a practical verification tool, evaluating its effectiveness through comprehensive field trials, and refining its design for optimal performance. By pursuing these objectives, this research seeks to establish a verification system that not only reinforces national nuclear safety but also strengthens international trust and cooperation, reaffirming the commitment to the peaceful use of nuclear energy.

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