

Analysis of Nuclear Material Accounting and Control Technology in Spent Fuel Reprocessing Plant

After 60 years of development, China's nuclear fuel cycle front section, including uranium exploration, mining, metallurgy, purification, uranium conversion, uranium enrichment, fuel manufacturing, has formed industrial capacity; however, the nuclear fuel cycle back section has not yet formed industrial capacity, we lack commercial-scale power reactor spent fuel reprocessing plants, and have not formed MOX fuel element production capacity, and there is still a gap with the nuclear power.

During the 13th Five-Year Plan period, China will strengthen the research of spent fuel reprocessing technology and build a 200-ton/year demonstration plant for spent fuel reprocessing. Meanwhile, China is planning to build an 800 ton/year commercial reprocessing plant with France.

Nuclear material accounting and control is an important part of operation and technological process control for spent fuel reprocessing plant. Nuclear material accounting and control is an important technical means of domestic nuclear material control, and an indispensable link to support the implementation of bilateral agreements or multilateral international obligations.

At present, our commercial spent fuel reprocessing plant has insufficient experience in accounting and control of nuclear materials, and technology needs to be improved urgently. Guidelines, monitoring schemes and review outlines need to be further improved.

This paper systematically investigates and analyses the status of nuclear material control in domestic spent fuel reprocessing plants. This paper investigates the development history, implementation status and experience and lessons learned from the accounting and control measures for nuclear material in foreign commercial spent fuel reprocessing plants, and the evolution of IAEA's safeguard and supervision scheme for commercial spent fuel reprocessing plants.

The key measurement points of material balance area and physical inventory in typical commercial spent fuel reprocessing plants, the overall design requirements of nuclear material accounting and control measures, on-line process measurement and monitoring, and near-real-time accounting are analyzed. Based on the investigation results and analysis, and in view of the present situation of nuclear material control in China, some preliminary suggestions are put forward for the preparation of nuclear material control technology for commercial spent fuel reprocessing plants in the future. Including the accounting and control of nuclear materials should meet various requirements, promoting the preparation of accounting and control supervision of commercial spent fuel reprocessing plants, and the accounting and control measures of nuclear materials should be embedded in the overall design requirements of the project, so as to achieve three simultaneous ,etc.

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