SPEAKER / PRESENTATION INFORMATION

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Title	***Progress of Above 5% Enrichment Fuel Development in Japan***		
Abstract	**1. Scope of development for above 5% enrichment fuel in Japan's NGR project.** In 2008, Japan began to develop a next-generation light water reactor (NGR). The development of above 5% enrichment fuel is one of the major concepts of the NGR. Since the design for the NGR requires 70GWd/t in discharge average burnup with a 24-month cycle operation, the required enrichment becomes above 5%. **2. Status of study of criticality safety issue above 5% enrichment fuel.** After the first two years of development, we plan to evaluate the technological impacts, countermeasures, and fuel cycle economy of the introduction of 10% enrichment to current fuel cycle infrastructure. Criticality safety, shielding radiation, and heat removal are the typical technical impacts in fuel cycles. Regarding the front-end cycle, we found that there is a narrow margin of criticality limit on current fabrication facility in the study if above 5% enrichment uranium is introduced. Regarding the back-end cycle, especially radiation from gamma, beta and alpha in some reprocessing process becomes two or three times larger than 45GWd/t fuel process. Poison reactivity credit by dilute burnable poison is the new concept for countermeasure of criticality limit of above 5% enrichment, such as fuel fabrication and fresh fuel transport. By introduction of dilute poison credit, some existing equipment in the front-end facility, such as the fuel storage vessel in fuel fabrication facility, becomes usable as is. This means the reduction of renewal of equipment. Typical poisons are erbia (ErO2) and gadolinia (GdO2). The fundamental applicability of the dilute poison credits has been evaluated in this development.		

	Some applicability of dilute erbia had been already evaluated in other METI (Ministry of Economy, Trade, and Industry - Japan) projects of above 5% enrichment. The typical required content of erbia in 10% enrichment uranium becomes 3.7%. Some physical property impacts, such as melting temperature and capability of uniform mixing of the low contents of erbia in liquid solution, have been evaluated in this development. Some applicability of dilute gadolinia, such as reactor core performance, had been presented in some papers. The required typical content of gadolinia becomes 50 ppm in 6% enrichment of UO2, and 300 ppm in 10% enrichment of UO2 because of very large thermal absorption cross section compared with erbia. An above 5% enrichment UO2 fuel with “minimal-content gadolinia (MCG)” has been called out in the past papers, and the intrinsic issue of MCG is the impact of inhomogeneous mixing of very dilute poison compared with erbia. In case of the powder mixture of the particle size of UO2 between one micro meter and two micrometer, we found several percentage of gadolinia should be increased in this study. **3. Plan of criticality safety experiment with critical assembly facility.** Critical experiments for homogeneous solution systems of the above-5wt% fuel have been performed with STACY facility of JAEA. We are planning critical experiments for heterogeneous systems of the above-5wt% fuel rods under this NGR project.