Systematic Comparison of Fuel Cycle Options using Mass Flow Data in Fuel Cycle Data Packages

T. K. Kim[1], T. A. Taiwo[1], E. A. Hoffman[1], R. Wigeland[2]
[1] Argonne National Laboratory, U.S.A
[2] Idaho National Laboratory, U.S.A

Abstract

The Department of Energy's Office of Nuclear Energy (DOE-NE) has issued a Nuclear Energy Research and Development Roadmap report discussing its nuclear research, development and demonstration activities that will ensure nuclear energy's continuing contribution as a viable energy option and its possible expansion in the United States. One of the key objectives stated in the roadmap is the development of sustainable nuclear fuel cycles that improve natural resource utilization and that provide adequate capability and capacity to manage wastes produced by the fuel cycle. To achieve this objective and enable prioritization of future activities, the DOE-NE Fuel Cycle Technologies (FCT) Program Office is conducting an evaluation and screening of nuclear fuel cycle options. As part of the evaluation and screening effort, Fuel Cycle Data Packages (FCDPs) are being developed for collecting high-quality and traceable technical data on fuel cycle options. An FCDP consists of (1) a System Datasheets file, which contains fuel cycle system information for a specific fuel cycle option, and (2) Technology Datafiles, which are wiki-style information on technologies supporting the fuel cycle option.

Currently, FCDPs for a wide-range of fuel cycle options, including once-through, limited-recycle, and continuous-recycle systems, have been partially developed. The mass flow data that are part of the system datasheets have been compared and presented in this paper, for selective fuel cycle options. Systems parameters compared in the paper include the required mass of natural uranium or thorium, utilization of natural resources, required capacity of separation facility, amount of waste, etc. A preliminary assessment of the relative performance of the fuel cycle options to a reference once-through fuel cycle option is also provided.