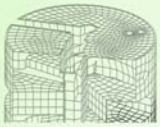
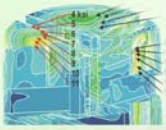
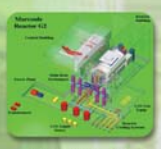
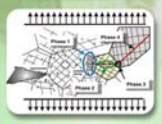




Modeling and Simulation Group



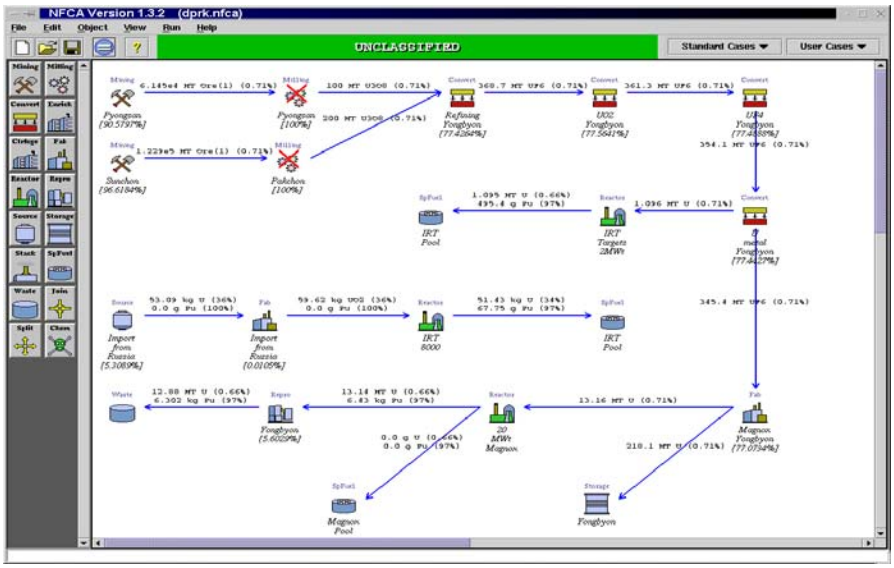


Analysis of Material Flow in the Nuclear Fuel Cycle

Nuclear Fuel Cycle Analyzer (NFCA)

The Nuclear Fuel Cycle Analyzer (NFCA) provides the capability to compute the material flows (including uranium, plutonium, and secondary chemicals) for each step in the nuclear fuel cycle. The primary role of NFCA is to determine the material requirements and flows for the clandestine production of nuclear weapons materials. All of the components of the fuel cycle (mining, milling, conversion, enrichment, reprocessing, and storage) can be included in the modeling at least to some degree. The calculation methodology of the NFCA consists of models for fuel cycle facilities and an algorithm that uses linear programming to determine the most optimal solution. The solutions can be performed for either steady-state or batch production processes. In the problem setup the user can model all or part of a country's fuel cycle and specify facility capacities, material limits, or production quotas. NFCA then computes all of the flows throughout the entire fuel cycle to match the user input.

NFCA includes a highly interactive graphical user interface to allow the user to easily perform "what-if" calculations. The user can interactively select fuel cycle components and construct a fuel cycle of interest. Original development of NFCA was funded by DIA in the mid 90's. More recently the NFCA algorithms for uranium processing and enrichment were significantly updated and extended for an analysis of the HEU production cycle. An NFCA flow diagram for a typical HEU uranium enrichment cycle is shown below.



NFCA Flow Diagram for a Typical HEU Uranium Enrichment Cycle

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