A Computer-Based Tool for Integrating Environmental Impacts into Decision Making

Argonne developed a computer-based tool for integrating costs and environmental risks into decision making. The initial application was for managing the U.S. Department of Energy's (DOE's) inventory of depleted uranium. Known as the Depleted Uranium Hexafluoride (DUF6) Management System (DMS), the tool allows quantitative comparisons of user-defined management and operation scenarios. DMS provides information on the cost and environmental impacts of many potential scenarios in graphical and tabular displays in a matter of minutes. The system architecture makes it easily exportable to other situations, and it has been used to evaluate a series of policy and budgetary initiatives.

PROBLEM/OPPORTUNITY

Programmatic, budget, and operational decisions are often made under time constraints and changing situations that limit the use of inputs from expansive models and technical analyses. Costs and environmental risks are often key factors in these decisions. A computer-based tool that would quickly develop quantitative, accurate, verifiable, and reproducible projections of the cost and environmental impacts from various options could improve decision making by reducing the potential for error and uncertainty. This tool would be especially valuable if it were flexible enough for use in applications beyond those for which it was designed. Argonne staff developed such a tool, called DMS, to support DOE's Depleted UF_6 Program.

APPROACH

A two-phased approach was used to develop DMS. In the first phase, Argonne staff worked closely with DOE to develop a detailed, conceptual framework of the program. Key challenges, variables, relationships, and data needs in the depleted UF_6 management process were identified. The resulting domain served as the basis for the configuration and data development in Phase 2. In the second phase, a computer-based architecture was configured to capture the relationships identified in the domain.

The architecture was designed to be exportable, so it would allow "plug and play" of data and submodels without having to be reconfigured. It consists of three modules: database, analytical model, and graphical user interface (GUI). The GUI provides an
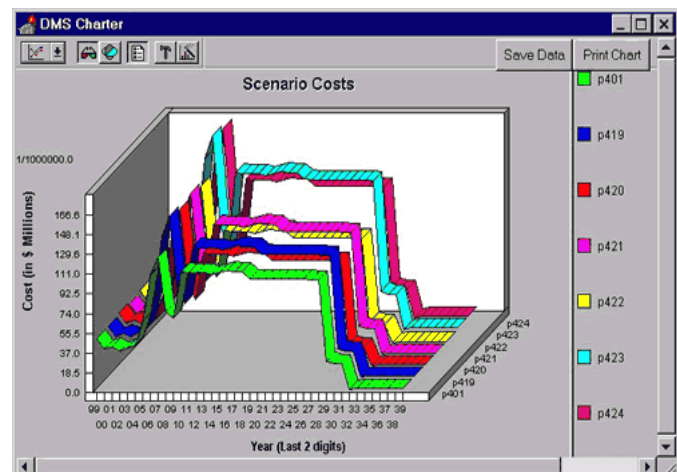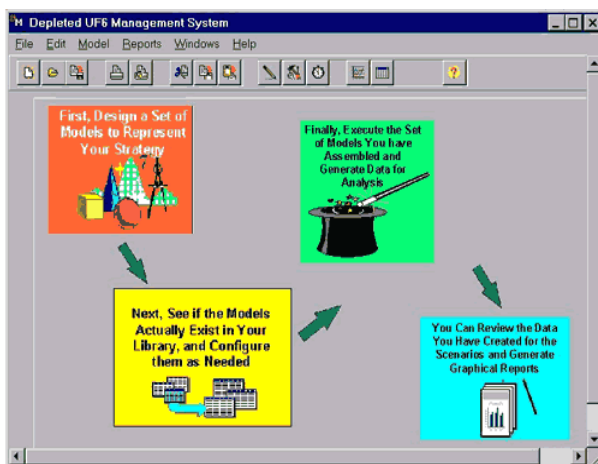
DMS provides easy-to-understand instruction and graphical displays.

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avenue for the user to create scenarios by describing operational components and management options. It lets the user select the activities to include in customized scenarios. Other DMS features allow the user to develop, save, and import scenarios and notify the user if the actions that he or she has specified exceed the constraints incorporated in the domain.

The GUI also displays analytical results in graphical or tabular form and allows comparisons of impacts from different scenarios as well as examinations of impacts across time.

After its development, DMS was tested for validity against the outputs of independent cost and environmental impact studies, and it was tested for usability by DOE managers and staff.

The database stores information or subanalytical models that allow the calculation of impacts from the activities described in the scenarios. Activities are characterized in terms of unit requirements and unit impact potentials and in terms of their relationships to other activities. Engineering, cost, environmental impact data and models that were developed independently by other Depleted UF_6 Program elements, provided the unit terms and submodels. The analytical model describes potential flows of activity associated with depleted uranium management options. It calculates costs and risks from user-defined management scenarios. It operates quickly to allow for real-time use by decision makers.

RESULTS

DMS projects and displays the costs and environmental risks associated with user-defined depleted UF_6 management scenarios. It quickly provides quantitative, reproducible, and verifiable data on which to base future decisions.

DMS software is a stand-alone application that can be installed on any 586 or faster computer configured with MS Windows 95 or NT. No additional software licensing is required. DMS can be installed on a user's hard drive and requires 16 MB of RAM and 15 MB of available disk space for storing the system software, database, and GUI. It uses SVGA resolution and a mouse.

DMS has been delivered to the sponsor and was used to respond to a series of policy initiatives. The sponsor used DMS to project the cost and risk impacts from a series of proposed budgetary decreases.

FUTURE

The DMS architecture is readily exportable to situations in which the cost and environmental risk impact, from potential management decisions, needs to be quickly evaluated.

COMMUNICATION OF RESULTS

DMS was the subject of several presentations to DOE headquarters and operations offices. DMS was also demonstrated to the management and operations contractors for the depleted UF_6 storage sites at Paducah, Portsmouth, and Oak Ridge.