Shipment Mobility/Accountability Collection (SMAC)*

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SMAC is the U.S. Department of Energy's (DOE) information system that collects, stores, and analyzes information on all unclassified shipments to and from DOE facilities. SMAC is operated for and under the direction of DOE's Office of Environmental Management (EM) Transportation Management Division (TMD). Mr. Larry Blalock is the manager of TMD and Mr. Tony Thomas is the functional area manager responsible for TMD's information technology activities, including executive management of SMAC operations and development. Funding is provided through DOE's Oak Ridge Operations Office. SMAC operations and development activities are managed by Oak Ridge National Laboratory (ORNL) for DOE. Technical support for day-to-day operations and development is provided by Science Applications International Corporation (SAIC) under contract to ORNL. DOE has used SMAC for more than a decade to obtain transportation management information essential to DOE's transportation and other related functions.

SMAC has undergone major changes over the years to adapt to DOE's changing needs, computer technology, and user environment. Today, SMAC is a minicomputer-based, relational database management system with controlled user access through local workstations, PCs, and dumb terminals. It works with other TMD information systems and routing models to collect data and perform complex data analysis.

Currently, SMAC serves DOE Headquarters, Operations Offices, Field Offices, and 64 field locations. The system provides data and analysis services to DOE and its contractors, transportation managers, and specialists. It is used to collect data from the sources of transportation activities, screen the data to ensure their quality, train personnel who collect and report the data, analyze data elements, help users conduct their own analyses, and develop and present reports on DOE's transportation activities to DOE and contractor management.

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The SMAC system provides information on the history of DOE's shipping costs so that future costs can be estimated, and proposals for transportation services can be better evaluated. For example, SMAC system summaries have been used to compile information on prior shipments of highly radioactive materials so that DOE can respond to State, Tribal, and local officials' inquiries on historic shipment activities; support environmental assessments for shipping DOE spent nuclear fuel; plan the disposition of surplus fissile materials from the nuclear weapons program; and provide an historic perspective for work conducted by DOE to assess needs for transportation into the twenty-first century. The system also provides essential information for conducting audits of DOE field operations' compliance with DOE Orders concerned with transportation and packaging activities. The SMAC annual report provides an overview of DOE's historic shipments of radioactive, hazardous, and non-radioactive materials.

SMAC operations are carried out by a small team located in Oak Ridge, Tennessee. This team uses DOE's Transportation Information Network (TIN) computer located at ORNL and ORACLE software to manage DOE's transportation data. More than 5 million shipment records are on file and accessible to authorized users. The SMAC system offers 25 user-generated report formats, with new formats added when needed.

The SMAC staff also provides statistical analysis of data, structured searches, and specialized software modules for data queries. They train users and monitor and screen data to help ensure that data submitted are correct and appropriate. SMAC staff continually search for ways to improve the SMAC system.

SMAC data elements include origin/destination pairs, carrier identification, commodity type and classification, quantity shipped, transportation costs, packaging data, hazardous materials manifest information for hazardous waste shipments, and isotope data for radionuclide shipments.

History of SMAC

Before 1970, the Atomic Energy Commission (AEC) collected information on shipments and produced summary reports manually. As access to accurate commercial shipment information became increasingly important as a budget and operations management tool, an information system was needed to meet local data requirements and to facilitate comprehensive programmatic functions. Heightened public awareness of nuclear and hazardous materials issues also resulted in many requests for shipment information from Congress and the general public. It was costly and time consuming to manually compile shipment data to manage operations and respond to these requests for information. By 1974, the forerunner of the SMAC system, the Transportation Statistics Data Base (TSDB), was implemented. By 1979, coverage expanded from Oak Ridge Operations Facilities to include the Nevada, Richland, Idaho, and Chicago Operations offices.

After 1980, DOE assumed the nuclear energy research and development function of the AEC's successor agency, the Energy Research and Development Administration (1974-1980), as well as research and development work relating to non-nuclear energy sources.

DOE worked to upgrade TSDB with improvements in data collection, quality control, and accessibility. The system was expanded to include all operations and field office sites, the power administrations, and naval reactor sites. TSDB became SMAC in 1983 when DOE Order 1540.1A (superseded by DOE Order 460.2 in 1995) mandated that all DOE organizations and their contractors report their shipment activities to the SMAC system. SMAC now serves all major DOE sites and receives more than 50,000 data records each month, most by electronic file. All data reported since 1989 are maintained on-line for ready access, and all data reported since 1984 are available for special analysis.

SMAC originally provided only fundamental management information reports to its users. As the volume of data grew, DOE managers began to promote and support enhancements to SMAC's data structure, system infrastructure, and analysis services. Today, SMAC is the central records module of DOE's TIN.

How the SMAC System is Used

DOE and its contractors' transportation managers and professionals use SMAC often; most may access the system directly if they so wish. The SMAC staff prepare hundreds of special reports each year ranging from requests for simple collections of historic data on carriers used to ship a particular commodity to complex queries involving analyses of cost trends for carriage of commodities by various modes of transportation. For example, SMAC staff recently collected historic data on shipments of radioactive materials through several western states in the United States. ORNL transportation staff used the SMAC results to estimate the routes used and provided State governors with estimates of where, when, who, why, what, and how shipments had passed through their state. Table 1 shows an example of information provided to New Mexico on shipments of hazardous materials originating in, destined for, or passing through the state in 1994. DOE, State, and Tribal officials were able to use this information to discuss planned shipping campaigns.

Table 1. DOE Hazardous Materials Shipments Through New Mexico in 1994: Surface Transport

Shipment Type	Non-radioactive Hazardous Materials	Radioactive Materials
Originated in state	199	62
Destined for state	319	80
Estimated pass through state	831	934

SMAC is also used by DOE to monitor its performance in managing the costs of transportation services it procures. Figure 1 shows a cost trend analysis for truckload shipments of low specific activity (LSA) radioactive materials.

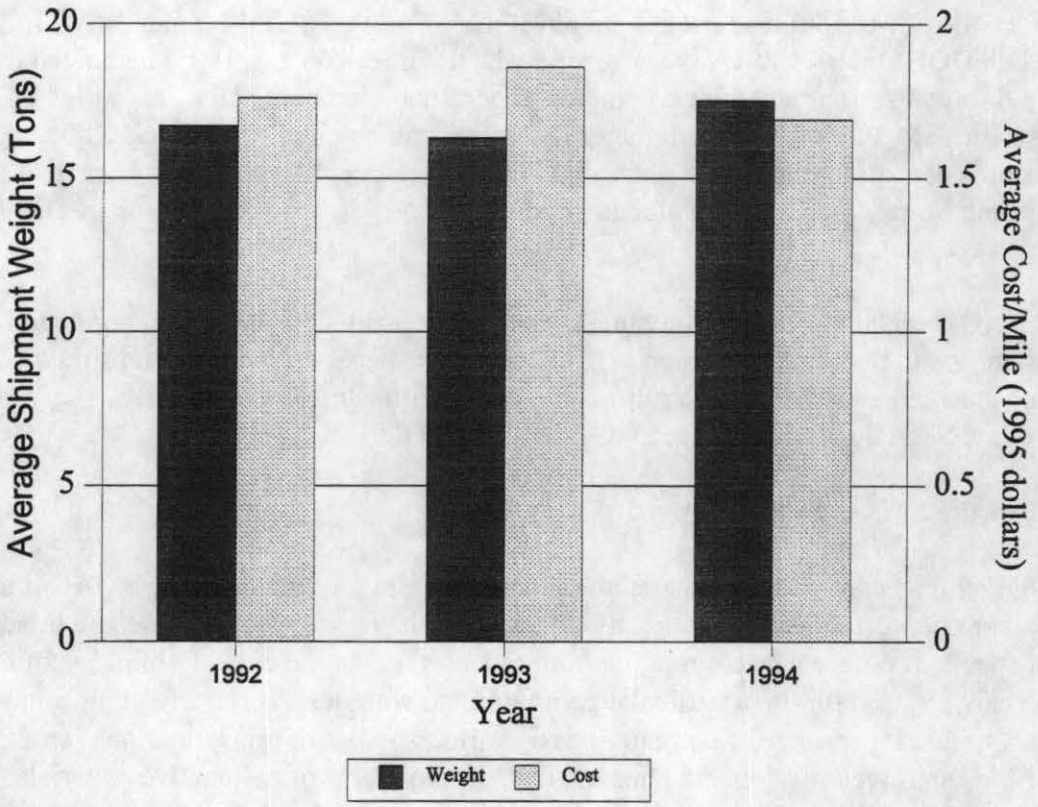
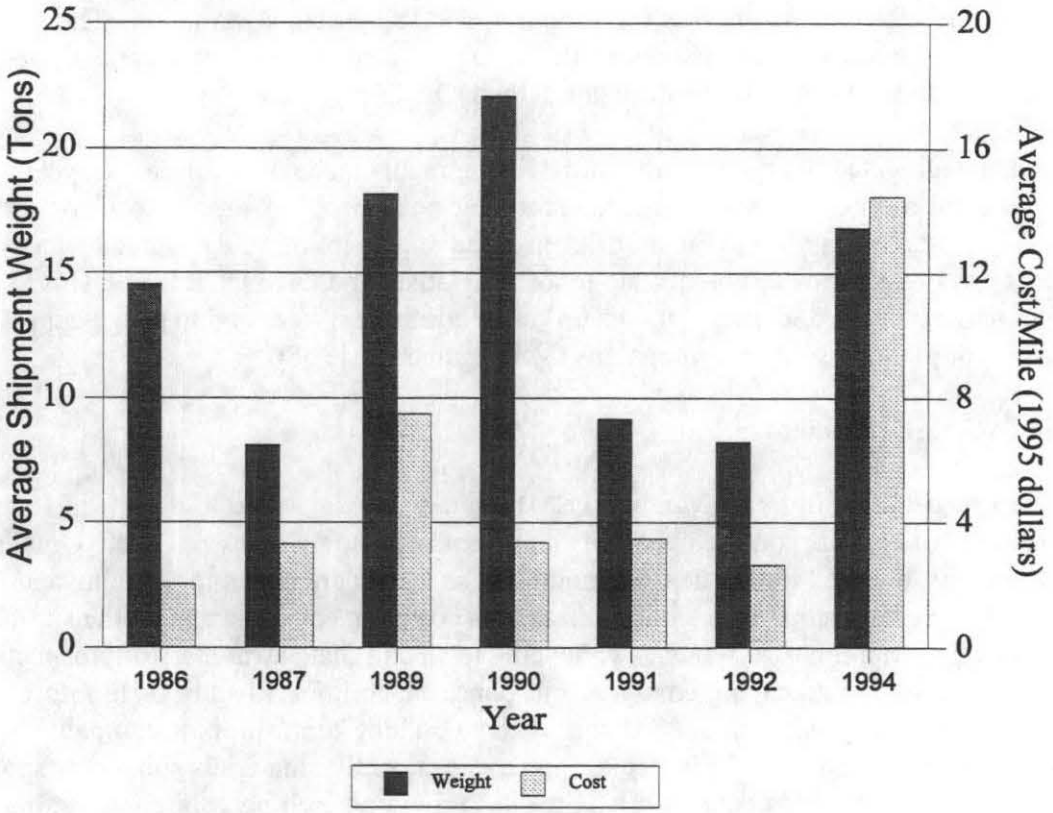


Figure 1. DOE Truckload Shipments for Radioactive Materials, LSA

In this example, costs reported to SMAC were adjusted for the declining value of the dollar and illustrated that real transportation costs for LSA materials have remained relatively constant over the 3 years analyzed. The average weight of the truckload quantities of DOE's LSA materials shipped also remained fairly constant during the same 3-year period.

SMAC helps DOE managers analyze unusual transportation activities. Figure 2 shows a very high cost-per-mile for shipments of special form radioactive materials in 1994 as compared to the previous years shown. Analyses of the SMAC data showed that shipments of cesium capsules from a facility in Colorado to Hanford, Washington, accounted for the reported high costs. There were several non-technical reasons for the high costs. For example, DOE and the corridor states had agreed that shipments would not be made during inclement weather. The highway carrier's crew and trucks waited 2 weeks for approval by all involved parties. This delay led to detention charges that greatly added to the shipment costs.



Note: No data available for years 1988 and 1993.

Figure 2. DOE Truckload Shipments for Radioactive Materials, Special Form

SMAC provided the information needed to subsequently track down and fully investigate the reasons for transportation costs attributed to factors not normally considered in estimating the costs of transportation of radioactive materials. SMAC also provides DOE managers with information needed to evaluate lessons learned from past shipments, plan for future shipments, and discuss future shipments practices with involved parties.

SMAC data help to assess future costs of moving highly visible radioactive material loads in the United States. The costs of moving materials to support disposition activities, such as U.S. Nuclear Weapons Program plans to dispose of excess fissile materials, need to be budgeted. Traditional cost estimates might consider only the usual and customary costs of transportation for special form materials. However, significant institutional costs (e.g., detention charges) are included in the 1994 data (see Figure 2).

Each year an annual report using SMAC data is prepared summarizing DOE's shipment activity (Transportation Management Division 1995). In fiscal year 1994, over 588,000 shipments were reported to SMAC. Also in 1994, SMAC was used extensively to support DOE's Transportation Needs Assessment report that addressed all significant

domestic DOE transportation requirements for hazardous (both radioactive and non-radioactive) and nonhazardous materials (Pope et al. 1995). SMAC served as the source for historical inbound, inter-facility, and outbound shipment information. These data provided the basis for comparison with future projected shipping needs and also provided insight into shipping patterns throughout the DOE Complex.

When aggregated over the number of DOE shipments made over the past 12 years, the database becomes a robust source for economic analysis. The "should-cost" tool being used by DOE's Oak Ridge Field Office takes advantage of this data source by analyzing cost profiles of prior shipments and reporting statistical data to DOE users. This information is used to assess quotes for transportation services and to gauge expected costs for planned shipping campaigns (Maddigan et al. 1995).

SMAC Enhancements

The Prospective Shipment Module (PSM) is a new feature added to SMAC in 1995. This module collects data on high visibility shipments, including many radioactive materials shipments, planned for the next 12 months. These data are useful in planning and budgeting future shipments, coordinating transportation activities among the sites, identifying training requirements, enhancing local and State awareness of prospective shipments and in managing emergency response capabilities. In addition to information on high visibility shipments, PSM collects data on long-term shipping campaigns, highway route controlled shipments, and other radioactive materials shipments sponsored by DOE. PSM is updated quarterly with sites providing their best shipment estimates for the next twelve months. Table 2 shows an example of data included in PSM for Low Specific Activity (LSA) and Highway Route Controlled Quantity (HRCQ) shipments that originated from ORNL in 1995.

Table 2. Shipments Originating at ORNL

Origin	States Pass-Through	Destination	No. of Shipments	Commodity	Packaging	UN No.[1]	ERG No.[2]
ORNL	TN, AR, OK, TX, NM, AZ, NV	Nevada Test Site	58	RAM,LSA	Type A	2912	62
ORNL	TN, NC, SC	Savannah River	3	RAM Fissile, HRCQ	GE-2000	2918	65

[1] United Nations Hazard Class Identification Number
[2] Emergency Response Guide Number

SMAC will continue to serve as DOE's transportation information system and central repository for transportation records. As its role as the central module of DOE's TIN evolves, SMAC will collect additional data for TIN users including information on packages, high visibility shipments, transportation budgeting and planning, critical transportation documentation, and pertinent regulations. SMAC data quality and coverage will continue to improve as more sites use DOE's Automated Transportation Management System (ATMS) and submit data directly to SMAC. Electronic transfer of data from ATMS and select on-site material tracking systems will also improve data timeliness and reduce data collection costs.

As the central records management system, SMAC will provide for the maintenance and distribution of industry standard tables and codes from SMAC to other TIN systems. This feature will help to ensure the quality and consistency of transportation data throughout the DOE Complex. Other features planned include high-speed electronic data transfer and a graphical user interface.

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