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ENVIRONMENTAL RESTORATION

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Environmental Restoration

UNIVERSITIES COUNCIL ON WATER RESOURCES

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The Strategic Environmental Research and Development Program-- Environmental Restoration and More

John Harrison

Office of the Director of Defense Research and Engineering

Mark R. Graves

U.S. Army Engineer Waterways Experiment Station

Over the years, the Departments of Defense and Energy (DoD and DOE) have, in many ways, mirrored society as a whole in their handling of the gamut of environmental concerns, including defense industrial and installation waste products. Within the past few years our defense posture has adjusted to new requirements, and in response to these shifting priorities, Senator Sam Nunn envisioned a stronger role for the Defense establishment in addressing national environmental issues. In a Senate floor speech on June 28, 1990, he stated:

As our Defense requirements change, we have an opportunity to redirect this tremendous national resource toward the environmental challenges we face in the 1990's: understanding what we are doing to the environment today; cleaning up the damage we have done in the past; and, modernizing U.S. industries and government to establish and maintain technological leadership in this critical area in the future.

In the area of data gathering and analysis, the defense establishment is in a unique position to augment the capabilities of the civilian scientific community to conduct research on global environmental change in several important areas.

The Strategic Environmental Research and Development Program (SERDP) was established by Congress in Public Law 101-510 (November 5, 1990) (U.S.C., title 10, sections 2901-2904). As a DoD-led initiative in partnership with the DOE and the U.S. Environmental Protection Agency, the program's goals, formally stated, are

- (1) To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.
- (2) To identify research, technologies, and other information developed by the Department of Defense and the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies, and other information with such governmental and private organizations.
- (3) To furnish other governmental organizations and private organizations with data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.
- (4) To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities.

President Clinton and Vice President Gore reflected additional SERDP underpinnings with regard to Defense Conversion, as quoted in "Revitalizing Our Commercial Economy":

Expand Federal efforts to develop environmental technology and create the world's most advanced systems to recycle, treat toxic waste, modernize city sewage systems and clean our air and water, and develop new, clean energy sources.

Note that these purposes are broader than only supporting basic and applied research. They also include sharing DoD and DOE "... research, technologies, and other information. . ." with others, more widely distributing previously limited data, and identifying private sector technologies for DoD and DOE uses.

The fiscal year 1991/1992 SERDP projects fell into the broad categories of Remote Sensing, Installation Restoration and Waste Management, and Energy. The FY93 SERDP projects were further divided into the six thrust areas, Alternate/Clean Energy, Cleanup (Restoration), Compliance, Conservation, Global Environmental Change, and Pollution Prevention, which are currently used.

The FY94 SERDP was projected as a multiyear program (FY94-98) to pursue four lines of approach to support the formal goals. These approaches are to

- Identify and fund breakthrough or major-impact joint research, development, and demonstration (RD&D) programs that address mutual priority concerns of the DoD and DOE which are within the goals of SERDP.
- Identify and foster RD&D programs to help solve major national and international environmental problems using the Departments' technical and research capabilities, as well as their unique data collection and analysis capabilities.
- Identify opportunities to accelerate existing defense environmental quality RD&D programs, and fund those that address the priority concerns of the Departments.
- Identify and leverage existing technologies to address environmental concerns of DoD and DOE.

The combined efforts of DoD, DOE, and the U.S. Environmental Protection Agency are guided by the SERDP Council (composed of eight senior representatives from the three Federal partners), to ensure that the program is carefully planned, coordinated, and aggressively implemented through the organization outlined in Figure 1.

In response to the legislation and resulting goals, SERDP is focusing on DoD environmental concerns and those of DOE that overlap DoD environmental concerns (Figure 2). In addition to the powerful environmental partnership among DoD, DOE, and EPA, SERDP has the advantage of incorporating levels of research ranging from the most basic to development and demonstration.

Figure 3 shows the approximate distribution of the \$160 million FY94 SERDP appropriation. Environmental restoration (cleanup) is a significant SERDP participant, indicating its importance in the SERDP and national environmental picture. Arriving at the FY94 distribution of funds shown in Figure 3 involved a carefully coordinated multistep process. Figure 4 provides an idea of both the time and effort involved, and Figure 5 presents numbers to accompany Figure 4. The individual contributing partners reviewed the 1,300 proposals that were originally submitted and sent forward 752 for further formal review and evaluation. While most of the proposals that did not pass the initial screening proposed excellent scientific and engineering efforts, they either did not directly address SERDP goals or the highest priority environmental DoD and DOE environmental problems. Five months of intensive work were needed to review, evaluate, and prioritize the remaining 752 proposals into the FY94 program comprising 126 proposed efforts.

Figure 6 summarizes the 35 studies that were eventually funded in the restoration (cleanup) area, from the initial 240 proposals that were submitted.

The following sections provide more detailed information on the focus and scope of each of the six FY94 SERDP thrust areas.

Cleanup

DoD and DOE are responsible for thousands of installations, ranging from training bases to industrial production facilities. Many of the defense facilities have been operating for over a century. During some of this time, the agencies, like much of American society, operated the facilities without today's consideration of all environmental impacts. More than 10,000 current and former sites now require environmental cleanup, at a projected cost, using today's technology, of more than \$200 billion.

The cleanup goals of the Departments of Defense and Energy are to attend immediately to imminent threats to public health and safety and to remediate all defense sites as quickly as feasible within the constraints of available resources. The principal SERDP focuses of this area are cleanup/remediation techniques and technologies, monitoring and characterization methods and technologies, and assessment methods. This SERDP technology area focuses on research, technology development, and

demonstration to provide more efficient and effective means of environmental cleanup of soil, sediment, groundwater, surface water, and structures already contaminated by past practices with hazardous materials (including unexploded ordnance), radioactive (low-level mixed wastes), and toxic substances.

Technology is needed to reduce remediation costs, quicken the pace of cleanup, and protect human health and the environment. Experience with past environmental technology development has demonstrated a return on investment ranging from 10 to 1,000.

Within the Remediation technology area, the primary environmental concerns are those listed below. SERDP R&D is focused on the highest priorities of these requirements.

- Comply with various Federal and State regulations.
- Implement timely, effective, and affordable methods for characterizing sites.
- Ensure the use of effective, affordable remediation technologies.
- Continue development of knowledge concerning health effects from environmental impacts.
- Develop and subsequently use technologies that address the remediation of unexploded ordnance.
- Develop and demonstrate technologies that will effectively treat dense, non-aqueous phase liquids and other volatile and soluble phases of contaminants.

Compliance

The Departments' Compliance goal is twofold: to ensure that all applicable environmental rules and regulations are met and to eliminate or reduce the chances for Notices of Violation. DoD is projected to spend between \$2 and \$3 billion annually for compliance through the year 2000. R&D is being focused to reduce this cost and enable DoD compliance with all domestic, foreign, and international regulations while carrying out its missions.

This SERDP technology area includes work to support environmental monitoring, waste treatment, end-of-pipe recycling and disposal, marine risk assessment, and environmental management not directly related to site restoration, but related to meeting current and future environmental compliance requirements. It also includes understanding the transport and fate of defense-related wastes and pollutants, as well as the ecological and health impacts of these materials in the environment.

Both domestic and international environmental regulations are becoming more demanding. They affect issues ranging from control of hazardous materials and effluents, to air and water quality, to remediation methodologies. The primary affected defense activities include training installations; ordnance and weapons manufacturing, repair, and rebuilding installations; and ship maintenance.

At the international level, the International Maritime Organization's Marine Pollution Convention (MARPOL) Annexes (to which the United States subscribes) are restricting or prohibiting DoD operations in international waters and MARPOL Special Areas, unless the vessels meet international environmental statutes. In addition, other countries that host DoD facilities are implementing and enforcing compliance with regulations and standards that restrict or prohibit DoD operations in foreign ports and bases.

Conservation

DoD's and DOE's Conservation goals are to conserve, protect, enhance, and manage the natural resources under their control in an exemplary manner. By better understanding the environment in which they operate, the Departments can make sound land-use decisions to promote conservation, while continuing to fulfill their missions.

In response, the SERDP Conservation thrust area focuses on R&D to better understand, protect, and maintain biological, physical, and cultural resources in order to ensure compliance with environmental laws; sustainable use of land and coastal resources; and support for stewardship of those resources on relevant Federal lands. Those resources include all biophysical resources associated with and related to ecosystems and habitats and the facilities and landforms associated with historic and archeological resources.

Pollution Prevention

The Pollution Prevention Act of 1990 defines pollution prevention as "source reduction" and other practices that reduce or eliminate the creation of pollutants, through increased efficiency in the use of raw materials including energy, water, and other resources, or materials substitution. Pollution prevention includes equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of materials, and improvements in housekeeping, maintenance, training, or inventory control. Under the Pollution Prevention Act, end-of-pipe recycling, energy recovery, treatment, and disposal are not included within the definition of pollution prevention. However, practices commonly described as "in-process recycling" qualify as pollution prevention.

The goal of pollution prevention is to eliminate or reduce hazardous waste and environmental discharges to as near zero as feasible. However, pollution abatement techniques alone will be inadequate to satisfy those restrictions, and higher treatment costs appear unavoidable as regulators lower the discharge thresholds. A total understanding of system life-cycle environmental effects is necessary to fully comply with these new thresholds.

DoD and DOE have many unique requirements that demand specialized, high-performance materials or systems that are often environmentally hazardous (for example, the development and production of sophisticated weapons systems). As health and broad-based environmental effects become better understood, restrictions on the use of such materials have the potential to adversely affect the Departments' ability to conduct their missions.

SERDP Pollution Prevention initiatives are focused on the highest priorities among the following requirements:

- Decrease the quantity of disposed wastes.
- Decrease the high capital costs associated with the characterization/remediation of hazardous wastes.
- Design and acquire major systems with environmental ramifications as key evaluation components.
- Identify alternates for materials that have been statutorily eliminated, such as ozone-depleting substances.
- Increase efforts to manage wastes.
- Decrease the life-cycle, safety, and pollution impact costs.

Global Environmental Change

SERDP Global Environmental Change efforts focus on those defined by the U.S. Global Change Research Program (USGCRP) and are being fully integrated with and specifically identified as "Contributory" Programs in the USGCRP. The central goal of the USGCRP is to establish the scientific basis for national and international policy-making related to changes in the global Earth system. Responding to that charge, DoD, DOE, and EPA SERDP research objectives are focusing on the need to distinguish natural changes from anthropogenic impacts over a range of scales commensurate with the questions posed. Recognizing the potential dual-use application of this research, the SERDP authorizing language directs that the DoD/DOE technical assets and infrastructure be employed toward understanding major environmental issues. Work is including acquisition and organization of data and research results to quantitatively describe the total environment at global and regional scales. In particular, emerging science and technology research, sensor systems, and new and existing databases are addressing science and policy questions identified by the USGCRP while concurrently satisfying the needs of DoD and DOE.

Global climate change and stratospheric ozone depletion are considered high-risk problems that affect both the natural ecology and human welfare. Factors contributing to this level of risk include the large geographic scale of the problems, the very long time frame that could be required to mitigate the impacts, and the potential irreversibility of some effects.

Research opportunities to address these concerns include

- Integration of new and existing programs in data collection and analysis methodologies.
- Fundamental studies of essential environmental processes which address identified global environmental change issues.

- Environmental modeling of atmospheric and oceanographic phenomena at local and regional scales.

Energy Conservation/Renewable Resources

The DoD is the single largest user of energy in the world, with an annual energy consumption of over 150 million barrels of oil equivalent at a yearly cost of over \$3.2 billion. This equates to 2.1 percent of all of the energy used in the United States and accounts for 88 percent of all the energy used by the Federal Government. Electricity accounts for \$2 billion of DoD's annual energy bill.

In 1988, DoD set a goal of reducing its FY95 energy consumption by 10 percent over its FY85 consumption. This goal was extended to all Federal agencies by the Federal Energy Management Act of 1988 and has been increased to a 30-percent reduction goal by the year 2005. This equates to saving 45 million barrels of oil equivalent and cost savings of \$960 million annually.

The SERDP Energy Conservation/Renewable Resources thrust area focuses on the generation, transmission, use, and conservation of energy. This includes research, technology development, and demonstration of environmentally sound alternative energy sources to address the major concerns, which are to reduce the dependence on fossil fuel sources, as well as overall energy consumption, energy costs, and "greenhouse effects." This thrust area also focuses on processes that control fossil-fuel air emissions of fixed and mobile energy sources.

The mission of the Department of Energy is to develop innovative energy technologies to help achieve the objectives listed above. The Department of Defense is relying on DOE's technology development efforts, in that SERDP will act as a means to transfer this technology to the defense establishment and other Federal agencies.

Specific SERDP efforts are focusing on the highest priority activities to achieve the following objectives:

- Reduce energy consumption by 30 percent by the year 2005.
- Reduce emissions to comply with regulations.
- Use alternative energy sources.
- Reduce carbon dioxide emissions to 1990 levels by the year 2000.
- Reduce DoD facility energy consumption by 20 percent by the year 2005.
- Maintain energy security (conserve the strategic petroleum reserve).

SERDP Partnerships

SERDP's strength lies in its many participating organizations and individuals, its easily traveled two-way street between the Federal and non-Federal sectors, and its focus on a broad range of the highest priority environmental problems facing our nation and the world.

Partnering of academia, industry, and the private sector with DoD, DOE, and EPA is a centerpiece of this extraordinary "Partnership to Improve the Environment."

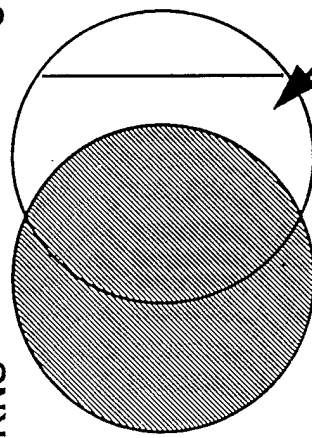
Dr. John Harrison is currently the Executive Director of SERDP in the Office of the Director of Defense Research and Engineering.

Mr. Mark R. Graves is a physical scientist at the U.S. Army Engineer Waterways Experiment Station, specializing in geographic information systems and remote sensing technologies.

Funding Possibilities

DOD ENVIRONMENTAL
CONCERNS

DOE ENVIRONMENTAL
CONCERNS



WEAPONS PRODUCTION

● = Funding Possibilities

FY 1994 SERDP FUNDING ALLOCATIONS

\$ Millions; \$160M Appropriation

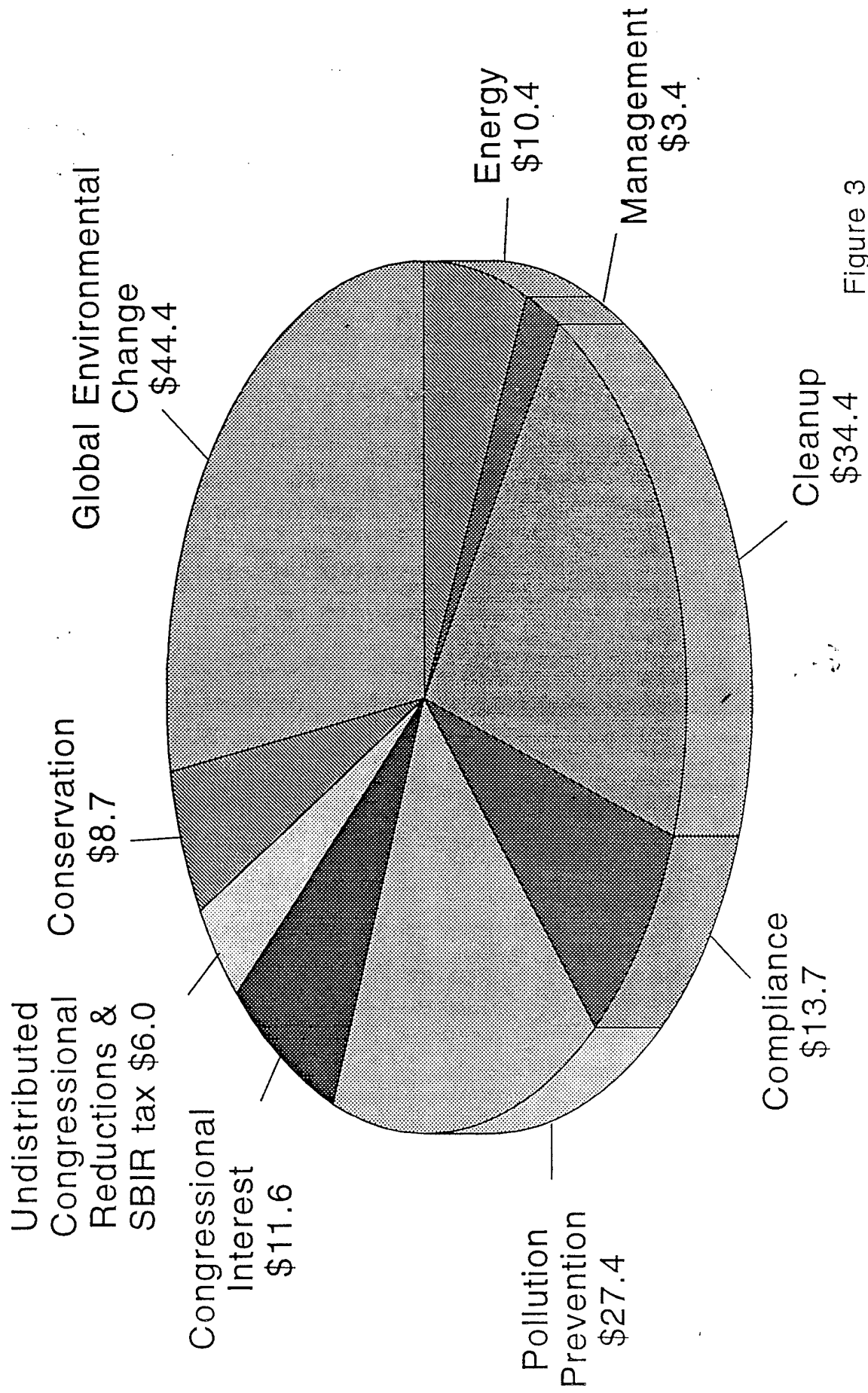


Figure 3

Figure 4a: FY94 Proposal Evaluation Process

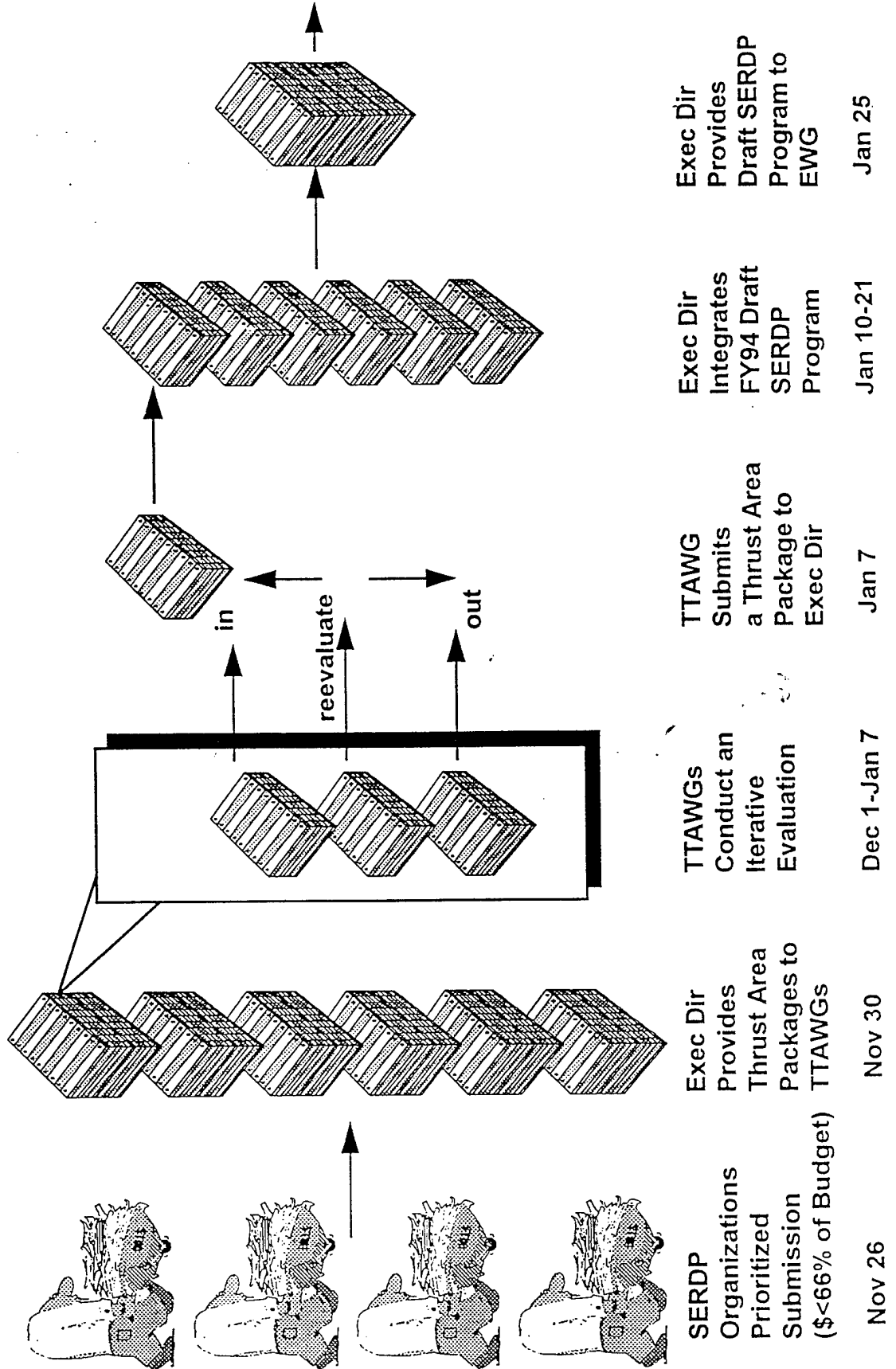


Figure 4b:

FY94 Proposal Evaluation Process

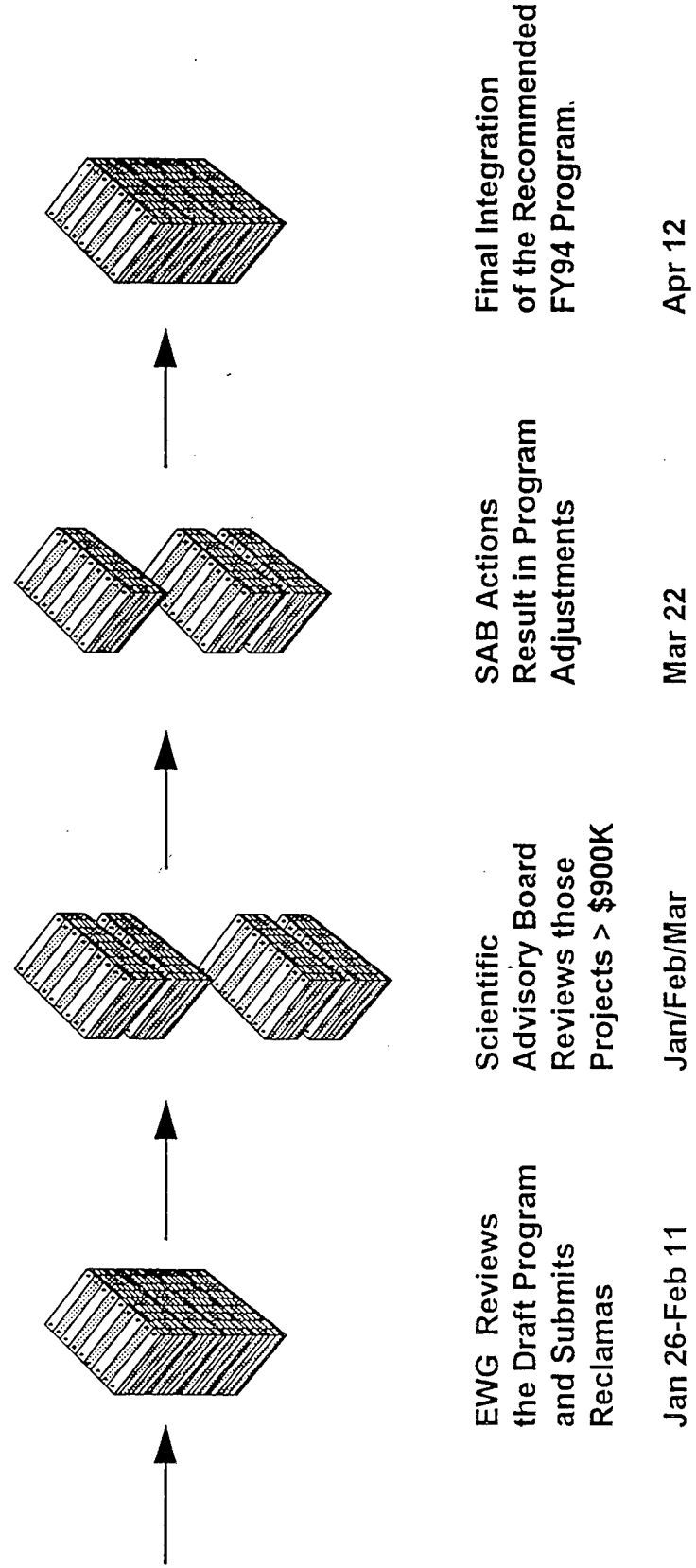


Figure 5

FY94 Proposal Summary

- 1300 Proposals Submitted
- 752 Submitted by Participating Organizations for Formal Review.
 - 240 Cleanup, 108 Compl; 35 Cons; 199 Poll Prev
 - 37 Energy; 133 Global Env. Chg.
- 126 Proposals for Funded in FY94
 - 35 Cleanup, 22 Compl; 11 Cons; 40 Poll Prev
 - 12 Energy; 6 Global Env. Chg.

Figure 6:

FY Cleanup Proposals

