

## Geologic Hazards, Resources, and Processes

Subactivity	FY 2000 Estimate	Uncontrol. & Related Changes	Program Changes <sup>1</sup>	FY 2001 Budget Request	Change from FY 2000
Geologic Hazard Assessment	69,111	+1,275	+2,850	73,236	+4,125
Geologic Landscape & Coastal Assessment	65,435	+1,804	+9,950	77,189	+11,754
Geologic Resource Assessment	76,676	+1,717	-4,009	74,384	-2,292
Total Requirements \$000	211,222	+4,796	+8,791	224,809	+13,587

<sup>1</sup> See Program Change section for details.

## Activity Summary

### Introduction

Through its programs within the Geologic Hazards, Resources, and Processes Activity, the USGS identifies and helps meet the earth science information needs of a wide variety of Federal, State, and local agencies, and the private sector. This information is used to evaluate resource potential, to define risks associated with natural hazards, and to characterize the potential impact of natural geologic processes on human activity, the economy, and the environment.

**Hazards** -- These programs are designed to produce information and understanding that will lead to a reduced impact of natural hazards and disasters on human life and the economy. The United States is subject to a variety of natural hazards (earthquakes, volcanic eruptions, landslides, coastal storms, and erosion) that present grave threats to people and property. The occurrence of these hazardous events are inevitable and uncontrollable. However, the extent of damage and loss of life can be reduced through pre-event planning; social, economic, and engineering adaptations; provision of real-time warning capabilities, and more effective post-event emergency response. Central to this pre-planning is the availability of accurate, scientifically based assessments that define the nature and degree of risk. The more precisely that risks can be defined, the greater the likelihood that appropriate mitigation strategies will be adopted (e.g., building codes for new construction and retrofitting; insurance systems, land use plans; design and location/routing of critical infrastructure such as highways, bridges, subways, water, sewer, gas, electric, and petroleum distribution networks). USGS geologic hazards programs conduct basic and applied research, gather data, operate monitoring networks, perform assessments, and disseminate findings to the public for the purpose of advancing capabilities to better define risk and encouraging appropriate response to these risks.

**Resources** -- These programs assess the availability and quality of the Nation's mineral and energy resources to include the economic and environmental effects of resource extraction and use. The availability and cost (both economic and environmental) of energy and mineral resources, their extraction and use, are limiting factors to human development. Throughout its history, our Nation has faced important, and often controversial, decisions regarding the use of

Federal lands, environmental management, and the supply of energy and mineral resources to sustain development and enable growth. Federal land management agencies are required to develop plans that reconcile competing demands for resource development with other human activities, while recognizing environmental values and providing for the sustainability of resources and natural environments.

Providing unbiased, scientifically valid assessments of the potential energy and mineral supply of the United States, and the environmental consequences of developing these resources, are core functions of the USGS. Historically, heavy emphasis within the USGS energy and mineral resource programs was given to fundamental research on ore genesis and the formation of mineral and energy deposits. The USGS energy and mineral resource programs have evolved in recent years to emphasize: (a) developing and applying improved methods for oil, gas, coal, and mineral assessments, through use of advanced computer modeling, (b) bringing together resource quality and availability data to enable assessment of environmental considerations by public and private entities involved in energy and mineral resource extraction and use, and (c) gathering and disseminating census-style information on the development and use of mineral and energy resources, both domestically and internationally for use by other government agencies and the private sector.

**Geologic Processes and Systems** -- These programs distinguish the effects of human activities from natural changes operating at or near the earth's surface to enable more effective and efficient resource and environmental management decisions. Society needs to develop knowledge of the Earth's natural processes and cycles -- their rates, frequencies, magnitudes, and how they affect each other. Armed with such knowledge, we can respond better to both natural and human-induced changes. Natural hazards are less costly if their likely effects can be mapped and quantified. Resources can be more efficiently used if the impacts of their extraction can be anticipated. Damaged or endangered ecosystems can be repaired more effectively if the natural processes that form and maintain them are accounted for in remediation plans. Strategies for conserving and using the Nation's lands and resources are improved when the natural processes at work are recognized as well as the costs of working against them.

### **Federal Role**

The Federal role in conducting science to understand geologic hazards, resources, and processes. This role derives from the U.S. Government's responsibilities to protect the lives and property of its citizens, to support continued economic growth and competitiveness, and to assist society in anticipating and coping with the enormous forces of nature that shape and control the landscape.

Natural hazards have significant social and economic impact on our Nation. Annually, as many as 10 potentially damaging earthquakes strike the conterminous United States and more than 5,000 shocks large enough to be felt occur throughout the entire country. The United States has 65 active and potentially active volcanoes, more than all other countries except for Indonesia and Japan. During the 20th century, volcanic eruptions in Washington, California, Alaska, and Hawaii devastated thousands of square miles and caused substantial economic and societal disruption and, in the worst instances, loss of life. Notably, volcanic ash poses a unique threat to air traffic. Landslides, which cause about \$1-2 billion in damages and more than 25 fatalities each year in the U.S., pose serious threats to transportation and housing as well as infrastructure that supports fisheries, tourism, timber harvesting, mining, and energy production.

The USGS geologic hazards programs contribute to the reduction of human and economic losses and disruptions associated with these natural hazards by (1) defining, assessing, and monitoring potential earthquake, volcano, and landslide hazards as the basis for loss-reduction strategies and actions by government and the private sector; (2) providing analyses and real-time information and warnings for improved disaster response, for reducing losses from future disasters, and for enhanced public awareness of these natural hazards; and (3) expanding the fundamental knowledge of earthquake, volcano, and landslide generation, effects, and geologic processes for more effective risk-mitigation and disaster-response strategies.

Minerals and mineral products account for about \$500 billion of the Nation's gross domestic product. The expanding need for minerals in the United States and the world demands research in new techniques and concepts to assess the Nation's mineral wealth and provide accurate mineral resource information for national policy. At the same time, Federal and State agencies and industry are concerned with the environmental consequences of past and current mineral extraction activities. The ability to make informed decisions about these issues depends on having current, accurate scientific information on known and potential resources and on environmental and economic implications of their development.

The Nation faces the challenge of simultaneously addressing an expanding appetite for energy, a growing dependence on imported oil, and an increasing demand that energy resource extraction and use be environmentally benign. The USGS addresses this challenge by generating and providing energy information. This information is used by others to shape policies regarding domestic and foreign energy resources, to make wise decisions regarding Federal land use, and to maintain a healthy domestic energy industry increasingly composed of smaller companies. Knowledge of the national and world endowment of oil, natural gas, and coal is of fundamental importance to informed decisionmaking regarding the security and economic welfare of the United States.

Every year greater proportions of the landscape are built upon and paved; large amounts of carbon dioxide, sulfur dioxide, methane, and nitrous oxides are released to the atmosphere; marginal lands are stressed by agricultural practices encouraging the spread of deserts; and prodigious quantities of wastes are buried just beneath the Earth's surface. Human activities such as these can be directed toward working with natural processes to the extent possible (at acceptable cost to society) and away from activities in conflict with natural processes (which incur maximum costs). A comprehensive understanding of the dynamism of the Earth's surface is essential if the Nation is to enjoy, rather than endure, life through the next century.

## **Customers and Partners**

**Hazards** -- The USGS cooperates and coordinates closely with local, State, and other Federal agencies and the university community to determine and provide for their needs for earth science information critical for developing mitigation strategies. For example, the USGS is an important partner of the National Earthquake Hazards Reduction Program, cooperating closely with the Federal Emergency Management Agency (FEMA), the National Science Foundation (NSF), and the National Institute of Standards and Technology (NIST). The USGS also monitors about 25 U.S. volcanoes posing the greatest risk and provides information on potential eruptions to Federal, State, and local emergency agencies. For example, the USGS cooperates with the National Weather Service (NWS) and the Federal Aviation Administration (FAA) who

provide warnings to the airline industry and aircraft on hazards due to volcanic ash from explosive eruptions. Through these and other cooperative arrangements, the USGS helps assure that the needs for risk assessments of hazards are met.

**Resources** -- The Federal Government manages about one-third of the Nation's land area. It also manages the Exclusive Economic Zone, which extends 200 nautical miles from the Nation's coasts and encompasses an area that exceeds the Nation's land area. The USGS is the primary provider of earth science mineral and energy resource information and assessments for Federal agencies such as the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) who are responsible for managing these areas. The USGS also works closely with the Department of Energy (DOE) in implementation of the National Energy Strategy. The USGS cooperates with many local and State agencies and coal and electric power producers to assess the availability and quality of coal resources. Every five years, the USGS publishes an assessment of the Nation's oil and natural gas resources. The assessment is used by land managers, energy producers, utility managers, and policymakers, among others. The USGS cooperates with State geological surveys in conducting coal availability and coal quality studies. Regional consortia are being developed between the USGS and the State geological surveys, electric utilities, coal producers, and with the Electric Power Research Institute to assess coal quantity and quality in several coal-producing basins. Finally, the USGS cooperates with hundreds of domestic and international producers and users of mineral commodities to compile reports on the supply and utilization of these resources for purposes of economic development and national security.

**Geologic Processes and Systems** -- The USGS coordinates with a large number of local, State, and Federal agencies on a wide range of geologic, coastal, and marine studies. For example, the USGS cooperates and coordinates with Federal land management agencies, including the BLM, USFS, National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), Bureau of Indian Affairs (BIA) and others to provide basic geologic and interpretive information tailored to their issues. On environmental issues, the USGS coordinates with the U.S. Environmental Protection Agency (EPA), DOE, the Department of Defense (DOD), and State and local environmental agencies to assist in characterizing sites and providing needed information on the nature, magnitude, and source of contamination problems. In the coastal environment, the USGS cooperates closely with the National Marine Fisheries Service, and the Sanctuaries and Reserves Division of the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers to provide the marine and coastal geologic information necessary for developing management plans. Locally and regionally, the USGS coordinates with State geological surveys and other State agencies, communities, and universities. The objectives of the close cooperation and coordination are to: (1) assure that the USGS is addressing priority issues and that the information is prepared and presented in a form that is readily usable and (2) assure that the appropriate mix of scientific expertise, including personnel from State and local agencies and universities as necessary, is addressing identified problems.