The National Dam Safety Program Fiscal Years 2000-2001

A Report to the Congress

NATIONAL DAM SAFETY PROGRAM

Federal Emergency Management Agency
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C01

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EXECUTIVE SUMMARY

On October 12, 1996, the Water Resources Development Act of 1996 (Public Law 104-303) was signed into law. Section 215 of Public Law 104-303 (33 U.S.C. 467) established the National Dam Safety Program and named the Director of the Federal Emergency Management Agency (FEMA) as its coordinator. The passage of the Act represented the culmination of years of collaborative effort on the part of many players in the dam safety community to statutorily create the National Dam Safety Program.

Public Law 104-303 provides for a number of initiatives in dam safety, including an assistance program to the states to improve their dam safety programs; funding for greatly expanded programs in research and training; and the creation of a National Dam Safety Review Board to monitor the state assistance program and advise the Director of FEMA on policy issues affecting national dam safety. Public Law 104-303 states that no later than 90 days after the end of each odd-numbered fiscal year, the Director of FEMA will submit a report to the Congress that describes the status of the National Dam Safety Program, the progress achieved by the federal agencies during the two preceding fiscal years in implementing the *Federal Guidelines for Dam Safety,* and the progress achieved by the states participating in the Program.

The National Dam Safety Program is dedicated to protecting the lives of American citizens and their property from the risks associated with the development, operation, and maintenance of America's dams. The control of water resources for navigation, industry, agriculture, and recreation has provided the United States with a strong legacy of dam development and operation. Public Law 104-303 codifies FEMA's ongoing collaborative relationship with other federal agencies, the states, and private interests to focus attention and energy on improving the safety of America's dams. This report to the Congress on the National Dam Safety Program, developed in collaboration with FEMA's partners, describes national efforts to improve dam safety in the United States.

Strengthening State Programs

The primary purpose of the National Dam Safety Program Act is to provide financial assistance to the states for strengthening their dam safety programs. In Fiscal Year (FY) 2000 and 2001, FEMA distributed a total of $8 million to all of the participating states and Puerto Rico for dam safety. Although the States of Alabama and Delaware still do not have legislatively mandated programs, FEMA will continue to work closely with the Association of State Dam Safety Officials (ASDSO) to encourage these states to enact and implement dam safety legislation.

There have been two notable improvements in the Nation's dam safety as a result of the state assistance funding. In 1998, the National Dam Safety Review Board, which was established by the National Dam Safety Program Act and serves as the leading national advisory group on dam safety, developed performance criteria for the states. The performance criteria are designed to capture information on the number of state-regulated high- and significant-hazard potential dams in each state with an Emergency Action Plan (EAP), the number of dam inspections conducted each year by each state, and the number of dams that have been identified by the states as in need of remediation.

A comparison of baseline data from the states for 1998-1999 and 2000-2001 indicates that Program funding has resulted in tangible increases in the number of EAP's over the past 2 years. On average, the states are reporting a 7 percent increase in the number of EAP's for state-regulated high- and significant-hazard potential dams. The number of dam inspections conducted by the states also increased dramatically since data was first collected for 1998-1999, from a total of approximately 13,000 inspections for 1998-1999 to 16,000 inspections for 2000-2001, an increase of 25 percent. Data from these and other critical areas demonstrate that dam safety has improved in the United States over the last 4 years as a result of the National Dam Safety Program Act.

Advancing the State-of-the-Practice through Research

Research funding addressed a cross-section of issues and needs in FY 2000 and 2001, all in support of ultimately making dams in the United States safer. An important component of the research program is the focus on the sharing of research between the federal, state, and private sectors.

In April 1999, the first full year of Program funding, a list of research needs and priorities for dam safety was developed. Since that time, the Research Subcommittee has sponsored a series of workshops in the priority areas and identified topics for additional workshops. As information has become available from the workshops, laymen's guides, expert level guides, and research workshop summaries have been produced. An important element of the research program is the integration of research results into training at the FEMA National Emergency Training Center and at other sites.

Over the next 5 years, the partners in the National Dam Safety Program will develop a long-term plan to identify and address research needs; to advance the state-of-the-practice; and to prototype successful activities, such as the research workshops, training, and expert level documentation. A primary strategy for the research program will be to broaden outreach and partnering efforts to agencies such as the United States Geological Survey, the National Science Foundation, and the National Weather Service, and to universities and the private sector.

Training Dam Safety Professionals and Dam Owners

Since the inception of the National Dam Safety Program in 1979, FEMA has supported a very strong, collaborative training program for both dam safety professionals and dam owners. With the training funds provided under the 1996 Act, FEMA has been able to expand existing training programs, begin new initiatives to keep pace with evolving technology, and enhance the sharing of expertise between the federal and state sectors.

Training activities supported by the National Dam Safety Program in FY 2000 and 2001 include direct assistance to state dam safety officers for training, the ASDSO Regional Technical Seminars, the National Dam Safety Program Technical Workshop Series, continued support for the Training Aids for Dam Safety program, and training in the development and implementation of EAP's.

Developing Information Technology Tools

The spectrum of information needs extends from those in the Congress who set national priorities and allocate fiscal resources to those of the dam owner/engineer involved in inspections, operations and maintenance, dam safety modifications, and other day-to-day activities of maintaining safe, economically viable facilities and environmentally responsible structures. Given the rapid pace of technology, those in a leadership role must recognize and make the best use of tools to accomplish their objectives. A primary objective of FEMA in its leadership of the Program is to identify, develop, and enhance technology-based tools that can help educate the public and assist decision-makers.

The National Performance of Dams Program, the National Inventory of Dams, and the Dam Safety Program Management Tools program have received major emphasis and funding under the National Dam Safety Program and are collecting invaluable data on the status of dams, dam incidents, and dam safety programs in the United States. In turn, these data are assisting Program partners in better documenting failure modes and identifying research and training needs.

Critical to the effective management of the Nation's dams is the need for comprehensive and complete information resources that support day-to-day dam safety activities and the development of effective dam safety policies. To meet these information needs, FEMA created the National Dam Safety Information Technology Committee (NDSITC) in 2000 and charged the Committee with the task of developing a strategic plan for a national dam safety information technology system. The strategic plan calls for the development of a virtual dam safety information technology network. The network will:

- Provide all basic data information needs for dam safety professionals that relate to the state of dams in the United States.
- Improve the efficiency and effectiveness of data collection, giving data providers the capability for seamless data submittal.
- Provide users with easy access and retrieval capabilities to a variety of distributed digital assets that support dam safety needs.
- Make available to users information on changes in the condition of the Nation's dams that are identified as a result of routine analysis of data from dam inspections and incidents.
- Maintain an awareness of the needs of the dam safety community, updating data accessibility as information needs change.
- Offer the opportunity to capture the explosion of valuable information, which if retrieved in a timely and efficient manner, can support continued developments in dam engineering and safety.

Outreach to the Public

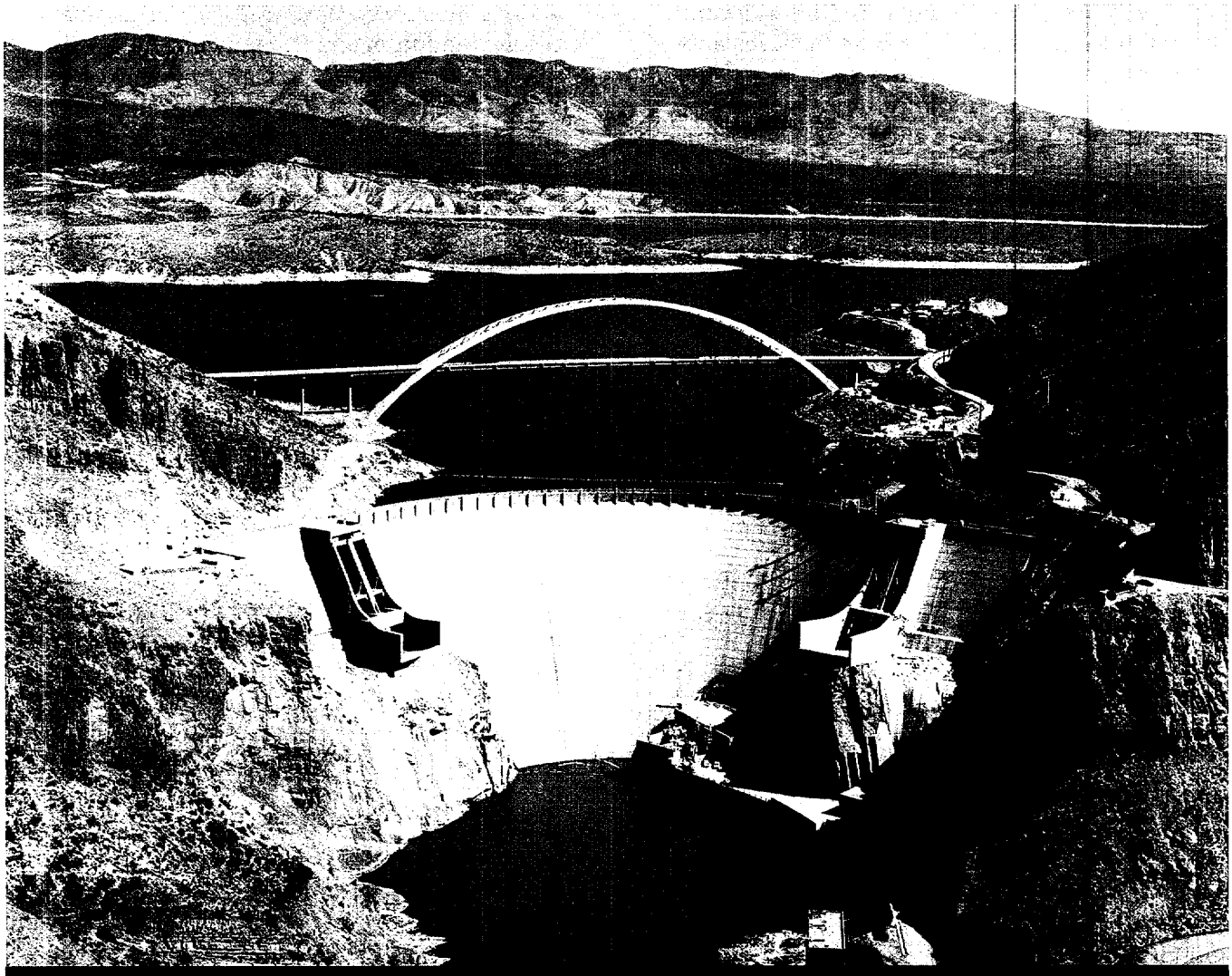
FEMA and its partners undertook a number of initiatives in FY 2000 and 2001 to heighten public awareness of the need for safe dams. In May 2000, on the anniversary of the Johnstown Flood, FEMA sponsored the first National Dam Safety Day. There was very active participation in the event by the federal sector and the states, including public service announcements, appearances by state dam safety officials on local radio and television stations, and the signing of Dam Safety Day proclamations by some governors. National Dam Safety Day provided the opportunity to showcase two public awareness items: *Dam Safety: A National Concern*, ASDSO's educational kit that focuses on the public, and FEMA's brochure on the National Dam Safety Program.

Maintaining Strong Federal Programs

Although the Federal Government owns or regulates only about 5 percent of the dams in the United States, many of these dams are significant in terms of size, function, benefit to the public, and hazard potential. Since the implementation

of the *Federal Guidelines for Dam Safety* in 1979, the federal agencies have done a commendable and credible job in ensuring the safety of dams within their jurisdiction. For FY 2000 and 2001, all of the federal agencies responsible for dams are implementing the provisions of the *Guidelines,* sharing resources whenever and wherever possible to achieve results and improvements in dam safety, and developing strategies to address diminishing resources and decreases in staffing levels.

During this reporting period, there was increased cooperation and coordination between the federal agencies and the states in many areas, such as emergency action planning, inspections, research and development, training, and information exchange. It is evident that the partnerships that have been fostered and enhanced by collaborative activities under the National Dam Safety Program Act are helping to meet the primary goal of the Act: "to reduce the risks to life and property from dam failure in the United States through the establishment and maintenance of an effective national dam safety program to bring together the expertise and resources of the Federal and non-Federal communities in achieving national dam safety hazard reduction."



Theodore Roosevelt Dam, Arizona

The Public

Dams serve our needs for flood control, water supply, recreation, irrigation, navigation, power production, and environmental purposes. The Grand Coulee Dam, built during the 1930's, is the largest concrete dam in North America and the third largest producer of electricity in the world. It supplies electricity to 11 Western states and irrigation to over 500,000 acres of farmland in the Columbia River basin. Other benefits are:

- Navigable channels provide an efficient and economic corridor for moving 2.3 billion tons of the Nation's domestic and foreign commerce.
- For every $1 invested to improve navigation infrastructure, U.S. Gross Domestic Product rises more than $3.
- Flood protection, on average, prevents $16 billion in damages each year, saving $6 for every $1 spent.
- Thousands of cities, towns, and industries rely on the 9.5 million acre feet of water supply storage from 116 lakes and reservoirs in the United States.
- Hydroelectric power dams produce enough energy to supply 4.64 million homes with power and produce $533 million in revenues to the Federal Treasury.

Consider some specific examples of the benefits of dams posted on the web site of the United States Society on Dams (USSD) at www.uss-dams.org.

Seattle City Light

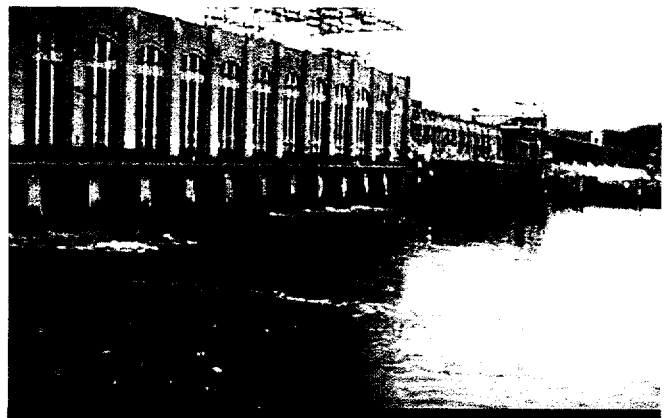
In recent years, both the National Hydropower Association and The Nature Conservancy have recognized Seattle City Light for environmental accomplishments associated with the Skagit River Hydroelectric Project. Seattle City Light works in collaboration with state and federal resource agencies, tribes, and conservation groups to protect salmon runs and preserve wildlife habitats. The Skagit Watershed supports the largest and healthiest runs of wild chum and pink salmon in the Pacific Northwest. Many salmon spawn directly below the

Skagit River, Washington

Project, where four- to six-fold increases in spawning numbers have been documented in recent years. Seattle City Light plans and monitors water releases carefully to protect the salmon during the early stages of their reproductive cycle. Nearly 2.5 miles of new off-channel salmon spawning and rearing habitat have been created or acquired at several upper Skagit sites. In addition to restoring salmon runs, an interagency agreement provides for long-term protection of wildlife habitat through land acquisition. More than 8,000 acres of critical habitat have been acquired, benefiting bald eagles, black bear, songbirds, and amphibians.

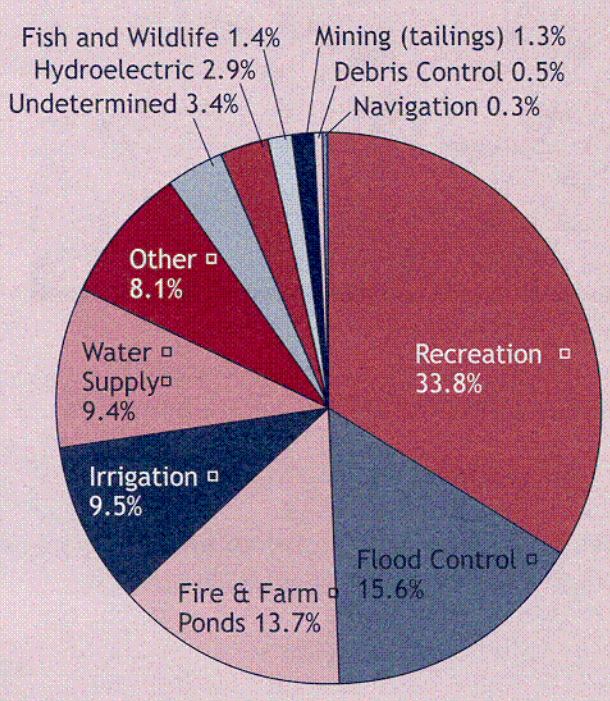
Susquehanna River

The dams on the Susquehanna River in Pennsylvania have been instrumental in preventing large-scale pollution of the Chesapeake Bay from sediment. The Susquehanna River Basin encom-



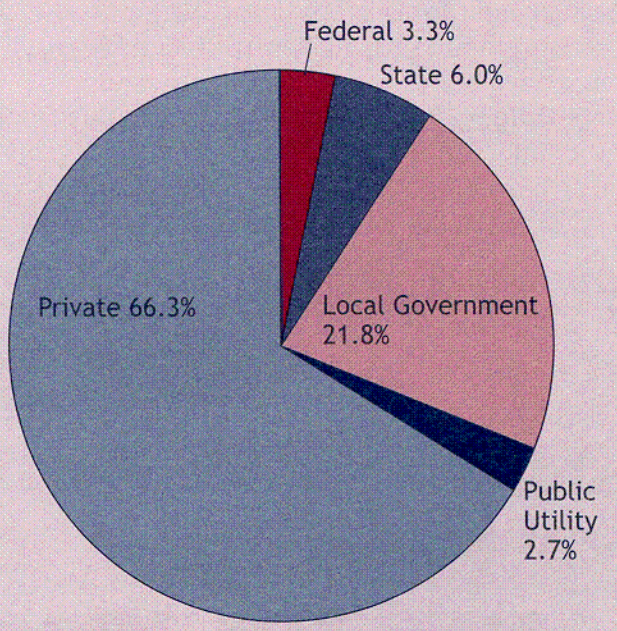
Conowingo Dam, Maryland

FIGURE 1
PRIMARY PURPOSE OF DAMS IN U.S.



Source: NID, U.S. Army Corps of Engineers, January 2001

FIGURE 2
OWNERSHIP OF U.S. DAMS



Source: NID, U.S. Army Corps of Engineers, January 2001

passes about 64,000 square miles and the River contributes about 50 percent of the fresh water supply to the Chesapeake Bay. The River also carries 3.1 million tons of sediment each year. Since 1928, more than 70 percent of the sediment has been retained by the Holtwood, Safe Harbor, and Conowingo Dams. The capacity of the Holtwood and Safe Harbor Dams to trap sediment, however, has been fully utilized. The last line of defense from the sediment is the available capacity remaining in the Conowingo Dam, which is estimated to last for about 20 years. Thus, the states bordering the Chesapeake Bay have time to develop better sediment controls to protect the valuable resources of the Chesapeake Bay.

Alabama Power Company

Without several storage reservoirs owned by the Alabama Power Company, the recent severe drought in the Southeast could have rendered the South a disaster area. The Southeast has experienced a prolonged drought that began in August 1999—the drought has caused widespread hardship, historically low reservoirs, increased power costs, limits on recreational use, affected water supply, and limited navigation. However, the storage projects did exactly what the engineers designed them to do during a drought: augment downstream flows so that needs were met. Storage releases on the Warrior River increased the base inflow by about 75 percent. On the Alabama River, releases from the tributary Coosa River and Tallapoosa River increased natural flows by 50 percent.

If the public is unaware at times of the many benefits of dams, the public also can be unaware of the risk dams present, particularly if they are not properly designed, constructed, operated, inspected, and maintained. The involvement of the public can heighten awareness of dam safety and motivate the public to become actively involved in achieving a safer community. A primary objective of the Federal Emergency Management Agency (FEMA) is to strengthen these partnerships, with the goal of making the public a full partner in dam safety.

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The Federal Emergency Management Agency

Dam safety is not solely a federal, state, or local issue. Dam safety can affect persons and property across local, state, and even national borders. An incident in one area can affect commerce, navigation, and power generation and distribution, or it can cause severe damage in another area. Therefore, there is a reasonable federal role to coordinate federal, state, and local efforts to provide dam safety to citizens.

Under FEMA's direction, experts, federal agencies, and others are developing and providing programs that are focused, coordinated, and data driven. The National Dam Safety Program is working with the states, individually and through the Association of State Dam Safety Officials (ASDSO), the United States Society on Dams (USSD), federal agencies, and other stakeholders in dam safety to encourage individual and community responsibility for dam safety.

Two federal organizations that have an important role in guiding the direction of the National Dam Safety Program are the National Dam Safety Review Board and the Interagency Committee on Dam Safety (ICODS), both of which are chaired by FEMA.

National Dam Safety Review Board
Authorized under Public Law 104-303, the National Dam Safety Review Board provides the Director of FEMA with advice in setting national dam safety priorities and considers the implications of national policy issues affecting dam safety. The National Dam Safety Review Board also helps oversee the development and support of state dam safety programs.

The membership of the National Dam Safety Review Board includes a representative from FEMA; representatives from four federal agencies that serve on ICODS; five members selected by the Director of FEMA from among dam safety officials of the states; and one member selected by the Director of FEMA to represent USSD.

Interagency Committee on Dam Safety
Since its formation in 1980, ICODS has encouraged federal and state agencies to establish and maintain programs, policies, and guidelines that enhance dam safety for the protection of human life and property. This is achieved through coordination and information exchange among federal agencies and state dam safety officials with common problems and responsibilities for dam safety. ICODS provides the permanent forum for the coordination of federal activities.

ICODS, which was formally established by Public Law 104-303 in 1996, is composed of representatives from all the federal agencies that build, own, operate, or regulate dams.

ICODS Agencies

- Department of Agriculture
- Department of Defense
- Department of Energy
- Department of Interior
- Department of Labor
- Federal Emergency Management Agency
- Federal Energy Regulatory Commission
- International Boundary and Water Commission (U.S. Section)
- Nuclear Regulatory Commission
- Tennessee Valley Authority

By the start of FY 1998, FEMA had reorganized all of the ICODS subcommittees to better meet the requirements of Public Law 104-303. Six subcommittees serve under ICODS and focus on activities essential to carrying out the goals of the National Dam Safety Program. During this reporting period, the Training Subcommittee and the Research Subcommittee played important roles in the operation of programs in their respective areas. Other Subcommittees that operated under ICODS during this reporting period are the Operations Subcommittee, the National Inventory of Dams (NID) Subcommittee, the Guidelines Development Subcommittee, and the National Dam Safety Coordination Subcommittee.

Federal Agencies

Since the enactment of Public Law 92-367 in 1972, which authorized the Corps to inventory and inspect non-federal dams, the Federal Government's position concerning the importance of correcting safety deficiencies of federal and non-federal dams has been quite clear. Presidential involvement, including President Carter's October 1979 Memorandum and Executive Order 12148, President Reagan's letter to Senator Paul Laxalt regarding water development programs, and President Clinton's designation of mitigation as the cornerstone of the federal multi-hazard emergency management system, further emphasized the need for a National Dam Safety

TABLE 1
SUMMARY STATUS OF DAMS FOR FEDERAL AGENCIES (FY 2000-2001)

DEPARTMENT	DAM INVENTORY				PERIODIC INSPECTIONS			
Agency	Total	Hazard Classification			Total	Since Last Report		
		High	Sig.	Low		Formal	Inter.	Const.
USDA (Total)	28153	2140	2713	22494	18311	1610	16351	350
ARS	1			1	1		1	
FS	1814[a]	406[a]	524[a]	884[a]	510[b]	10[b]	350[b]	150[b]
NRCS	26223[c]	1734	2189	21609	17800[d]	1600[d]	16000[d]	200[d]
RHS	60[f]							
RUS	55[f]							
DOD (Total)	861	498	130	233	726	284	337	4
USACE	609	466	98	45	699	273	323	2
Army	210	31	26	153	11	11		
Navy	16	1		15				
Air Force	26		6	20	16		14	2
DOE	16	2	1	13	17		17	
DOI (Total)	1732	349	111	1272	1116	356	585	5
BIA	286	77	40	169	117	75	37	5
BLM	495[h]	6	4	485	245		245	
BOR	312[j]	237	15	60	622	213	301	ongoing[k]
FWS	155	12	15	128	68	68		
NPS	483[l]	17	37	429	62[m]			
USGS	1			1	2		2	
FERC	2592	737	253	1602	3906[n]	301	2914	384
IBWC	7	3	1	3	210	2	208	
MSHA (Total)	1299	280	96	923	2743	2743		
Coal	711	252	33	426	1471	1471		
M/NM	588	28	63	497	1272	1272		
NRC	19			19	10	10		
TVA	82[o]	63	15	4	1683[p]	119	117	

Program to enable federal agencies to address dam safety problems expeditiously.

Below is a description of federal agency responsibilities for dam safety. Table 1, Summary Status of Dams for Federal Agencies, provides data on the number of dams owned, operated, or regulated by each agency.

The **U.S. Department of Agriculture (USDA)** is a major planner, designer, financier, constructor, owner, or regulator of more than one-third of all the dams in the NID. USDA dams provide livestock water, municipal water and wastewater, electric power, flood protection, irrigation, fish and wildlife habitat, recreation, sediment deten-

INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAP¤S	
¤00-01	Active	¤00-01	Active	High	Sig.
55	150	60	30	954	308
30[b]	50[b]	30[b]	10[b]	354[a]	108[a]
25[e]	100[e]	30[e]	20[e]	600	200
16	65	16	24	458	62
16	54	15	22	441	52
	4			17	10
	7	1	2		
2		1	1	2	1
62	183	35	42	282	50
6	13	4	5	29[g]	13
3	9	5	14	1[i]	1
40	107	5	5	237	15
5	30	10	9	12	15
8	24	11	9	3	6
152	79	74	96	737	253
				3	1
92					
74					
18					
	4			63	

a. FS owned and permitted.
b. Estimated, performed by FS.
c. Totals include dams with currently unknown but probably low-hazard potential classification.
d. Estimated, inspections are performed by NRCS and many other organizations without NRCS involvement.
e. Estimated, investigations, studies, or modifications can be done by dam owners without NRCS involvement.
f. Estimated, primary agency involvement as lender.
g. Many of BIA EAP¤s require upgrading revisions.
h. Low-hazard potential dams less than 25 feet or 50 acre-feet were dropped from this inventory.
i. BLM has an EAP underway for 1 high-hazard potential dam; EAP¤s are being developed for the remaining four dams. Three significant-hazard potential dams are being reclassified through a Service Agreement with BOR. EAP development will begin once the dams are reclassified.
j. BOR¤s 460 dams and dikes listed on the National Inventory of Dams are located at 312 individual facilities. Of the 312 facilities, 252 are classified as high- and significant-hazard potential facilities. The facility count is used for this presentation because inspections, investigations, modifications, and EAP¤s are counted and reported for individual facilities.
k. BOR performs quality assurance and construction contract administration activities on an ongoing basis for all dam and dam safety construction; total inspections for BOR include 108 special inspections.
l. No nationwide status report and updating since 1993.
m. No further breakdown available.
n. Total includes 308 special inspections.
o. Includes 49 main dam projects; the total includes saddle dams and dikes.
p. Civil, Mechanical, and Electrical are considered separate inspections. The total includes 1,381 monthly inspections and 66 special inspections.

tion, and manure storage. There are six agencies within the USDA involved with dams.

Agricultural Research Service (ARS) owns, operates, and maintains dams as part of its ongoing research programs in hydrology and hydraulics. ARS owns and operates only one NID dam.

Farm Service Agency provides financial assistance for dams through loans, loan guarantees, and grants to farmers and ranchers for land and water resource conservation or natural disaster recovery.

U.S. Forest Service (FS) designs, finances, constructs, owns, operates, and maintains and regulates dams in conjunction with the management of national forests and grasslands. FS owns approximately 1,000 NID dams and administers permits for approximately 2,000 privately owned NID dams.

Natural Resources Conservation Service (NRCS) designs, finances, and constructs dams under its technical and financial assistance programs for individuals, groups, organizations, and governmental units for water storage, sediment detention, and flood protection. The agency does not own, operate, maintain, or regulate any dams. NRCS has provided technical assistance for more than 25,000 NID dams and financial assistance for over 10,000 NID dams.

Rural Housing Service finances dams through loans, loan guarantees, and grants to public entities, local organizations, and nonprofit corporations for rural community facilities. The agency does not design, construct, own, or operate dams.

Rural Utilities Service finances dams through loans and loan guarantees under its Electric Program to cooperative associations, public bodies, and other utilities in rural areas for hydroelectric and thermal electric power plants. The agency also finances dams through loans, loan guarantees, and grants to rural communities under its Water and Waste Program for water and wastewater facilities.

The **Department of Defense** is involved extensively with dams as a permitter, owner, manager, planner, designer, constructor, and financier. There are four Department of Defense agencies responsible for, or involved with, dams.

Department of the Air Force has dam safety responsibility for dams located on Air Force bases in the continental United States. The Air Force has jurisdiction over 26 dams.

Department of the Army is responsible for dams that are either on Army installations or controlled by Army installations.

Department of the Navy has dam safety responsibility for dams located on Navy bases. There are 16 candidate dams under Navy jurisdiction for safety inspections.

U.S. Army Corps of Engineers has varying degrees of responsibility or jurisdiction for five categories of dams:

(1) dams which the Corps of Engineers planned, designed, constructed, and operates;
(2) dams which the Corps of Engineers designed and constructed, but are operated and maintained by others;
(3) those non-Corps of Engineers dams and reservoir projects subject to Section 7 of the 1944 Flood Control Act, the 1920 Federal Power Act, as amended, and other laws for which the Corps of Engineers is responsible for proscribing the regulations for the use of storage allocated to flood control and/or navigation;
(4) dams for which the Corps of Engineers issues permits under its regulatory authority; and
(5) dams that the Corps of Engineers inventoried and inspected under the National Dam Inspection Act of 1972, the Dam Safety Act of 1986, and the National Dam Safety Program Act of 1996.

The Corps of Engineers operates 276 navigation locks, 11,000 miles of commercial navigation channel, and approximately 1,200 Civil Works projects of varying types, including 609 dams.

The **Department of Energy** owns and has jurisdiction over 16 dams, as defined in the *Guidelines,* at 4 sites.

As the nation's principal conservation agency, the **Department of the Interior (DOI)** is responsible for most of the U.S-owned public lands and natural resources. Through its Bureaus, the Department is responsible for the planning, design, construction, operation, and maintenance of 1,732 dams meeting the definition in the *Guidelines.* In addition, the Office of Surface Mining (OSM) has regulatory responsibility for 1,370 dams associated with mining operations.

Bureau of Indian Affairs (BIA) works with the American Indian Tribes to operate and maintain its 117 high- and significant-hazard potential dams on Indian reservations.

Bureau of Land Management (BLM) is responsible for agency-owned dams on public lands in 11 Western States, including Alaska. The BLM dam inventory consists of 495 NID dams.

Bureau of Reclamation (BOR) is a federal water resource management and development bureau authorized to operate in 17 Western States. In carrying out its mission, BOR has developed water resource projects where dams play a major role in the viable development of the resources. BOR has reservoirs impounded by 460 dams and dikes.

U.S. Fish and Wildlife (FWS) operates facilities associated with fish and wildlife conservation on National Wildlife Refuges, waterfowl production areas, and national fish hatcheries. The FWS has an inventory of 155 dams.

National Park Service (NPS) manages 483 stream-flow control structures and monitors the status of 262 non-NPS structures which are within or adjacent to park boundaries. An important aspect of the NPS dam safety program is the removal of dams that are deficient and no longer essential for park operations. As land is acquired by the National Park System, dams are sometimes acquired incidental to the main purpose of the acquisition. To date, over 100 dams have been removed, with plans to remove more in the future.

Office of Surface Mining (OSM) regulates surface coal mining operations and the surface effects of underground coal mining operations. The OSM regulates 1,370 structures through the Western Regional Coordinating Center in Denver and the Knoxville Field Office in Tennessee.

U.S. Geological Survey (USGS) owns and maintains one low-hazard potential earthen embankment that offers no significant downstream hazard.

The **Department of Labor** responsibility for dam safety is vested in one agency. The ***Mine Safety and Health Administration*** receives its authority and responsibility for regulating safety and health-related aspects of the miners' working environment from the Federal Mine Safety and Health Act of 1977 (30 U.S.C. 801). The Act requires the Secretary of Labor to develop and promulgate improved mandatory health or safety standards to protect the health and safety of the Nation's coal miners or other miners. The Act specifically includes "impoundments, retention dams, and tailing ponds" as part of a "coal or other mine."

The **Department of State** responsibility for dam safety is vested in one agency. The ***International Boundary and Water Commission,*** which is composed of a U.S. Section and a Mexican Section, has jurisdiction over two large international storage dams and four small diversion dams on the Rio Grande and Colorado Rivers. The U.S. Sec-

Santee-Cooper Project, South Carolina

tion also is responsible for the maintenance of the American Dam and five NRCS arroyo control dams that are not fully international in nature.

The **Federal Energy Regulatory Commission (FERC)** is authorized by the Federal Power Act to issue licenses to individuals, corporations, states, and municipalities to construct, operate, and maintain dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary for the development of non-federal hydroelectric projects on (1) navigable streams; (2) public lands of the United States; (3) at any Government dam; and (4) on streams over which the Congress has jurisdiction under the Commerce Clause of the U.S. Constitution. As of September 30, 2001, there were 2,592 dams under FERC jurisdiction.

The **Nuclear Regulatory Commission** has regulatory authority over only (1) uranium mill tailings dams; (2) storage water pond dams at *in-situ* leach mining facilities; and (3) those dams integral to the operation of licensed facilities, or the possession and use of licensed material that pose a radiologically safety-related hazard should they fail.

The **Tennessee Valley Authority** is authorized by the Tennessee Valley Authority Act of 1933 to approve plans for the construction, operation, and maintenance of all structures affecting navigation, flood control, or public lands or reservations in the Tennessee River System. The agency has complete responsibility for the planning, design, construction, operation, and maintenance of its dams.

The States and ASDSO

The states have primary responsibility for protecting their populations from dam failure. Of the approximately 80,000 dams listed in the NID, state governments have regulatory responsibility for 95 percent. Although the programs vary in the scope of their authority, program activities typically provide for the safety evaluation of existing dams, review of plans and specifications

for dam construction and major repairs, periodic inspections of construction on new and existing dams, and review and approval of Emergency Action Plans (EAP's).

At the state level, efforts to regulate dams to ensure public safety surfaced after the failure of the St. Francis Dam in California in 1928, the second worst event after the Johnstown failure. A few minutes before midnight on March 12, the 188-foot high St. Francis Dam failed. The newly built dam, located about 60 miles north of Los Angeles, failed suddenly as a result of a foundation defect in an abutment. Warnings were not issued before the dam failure, and about 420 people died.

The failure of the St. Francis Dam led to the enactment of legislation in California, which became the model for laws in other states. By the mid-1970's, approximately one-half of the states had a system for protecting the public from the potential hazards of dams. Today, all but two states (Alabama and Delaware) have adopted dam safety regulatory laws.

Since its founding in 1984, ASDSO has moved to a leadership role in dam safety and now serves as the official voice for the states. There are four regions active in the support of the Association (Western, Southeast, Northwest, and Midwest), 48 full voting members including Puerto Rico, and over 2,000 members when Associate, Affiliate, and Student members are included. The web site address for ASDSO is www.damsafety.org.

The mission of ASDSO is to advance and improve the safety of dams by supporting the dam safety community through the following:

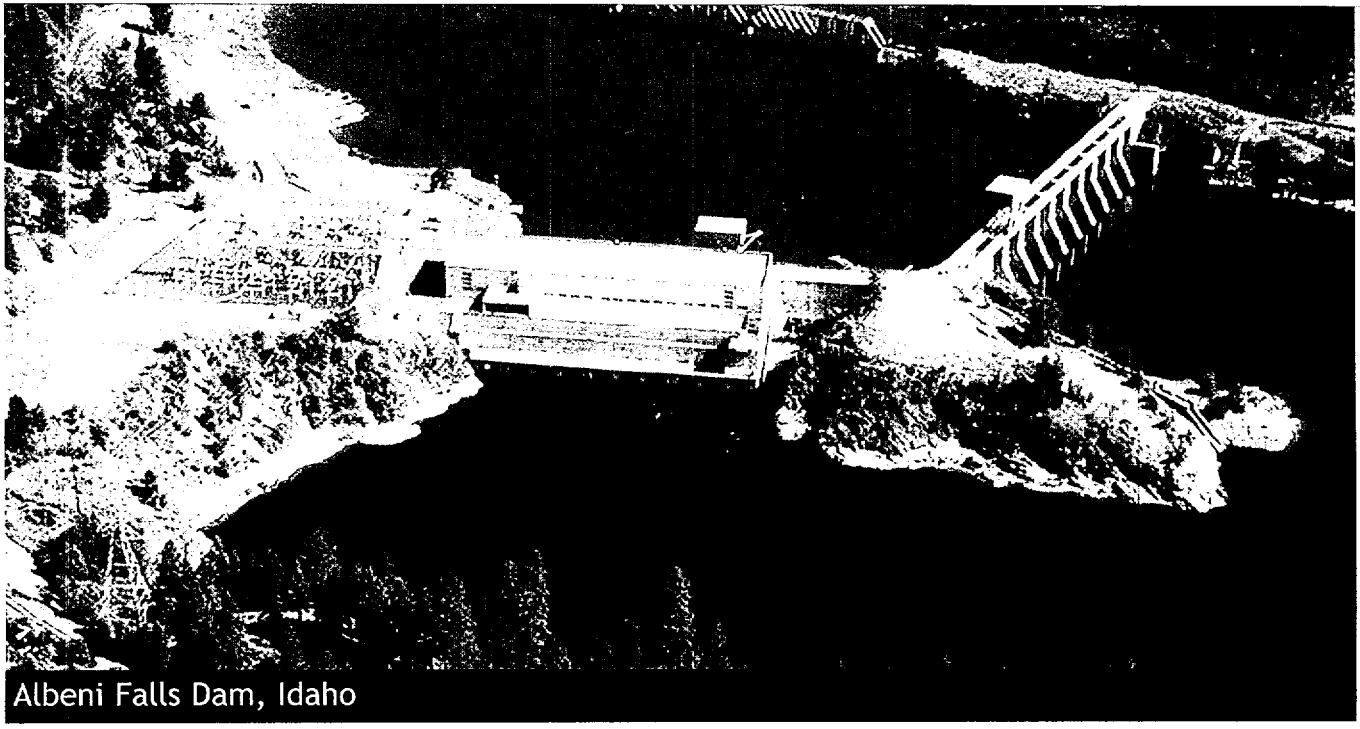
- Improving the efficiency and effectiveness of state dam safety programs.
- Bringing dam safety to a higher level of awareness among the general public, state and federal legislators, specific organizations, and other stakeholders.
- Providing leadership through facilitation of inter-organizational, intergovernmental, and interstate cooperation.
- Strengthening the dam safety community and providing a forum for the exchange of information.
- Providing representation of dam safety interests before state legislatures and before the Congress.
- Providing quality outreach programs for dam owners/operators, member and non-members, about the need to maintain safe dams.
- Managing the association effectively through internal policies and procedures.

ASDSO was very active in FY 2000-2001 with activities undertaken on behalf of the states and with initiatives funded under the National Dam Safety Program (described in the next section of this report).

ASDSO has working relationships with a number of organizations, including Southern University, Rebuild America Coalition, the National Emergency Management Agency (NEMA), the Canadian Dam Association, the American Society of Civil Engineers (ASCE), the National Watershed Coalition, and USSD. In 2001, ASDSO signed new partnering agreements with NEMA, the Ohio Dam Safety Association, and the ASCE Environment and Water Resources Institute. ASDSO also works in close partnership with FEMA and a number of federal agencies, including BOR, the Corps, and the NRCS. State participation on FEMA's National Dam Safety Review Board provides ASDSO with the opportunity to advise the FEMA Director on dam safety issues that concern the states.

Under the ASDSO Peer Review Program, experts in dam safety conducted reviews of the programs of the States of Maryland, Massachusetts, Wisconsin, and Nebraska, and of the federal dam safety program of the Corps. The final report from the Corps review was presented at the end of August 2001. Other peer reviews conducted by ASDSO include BCHydro, Ontario Hydro, and five DOI agencies, including BOR. In 2000, ASDSO updated its Peer Review Manual and made a presentation on "lessons learned" at its annual conference.

In FY 2000-2001, two new ASDSO task forces (the Committee to Develop a National Dam Repair Revolving Loan Fund and the Committee to Develop a Model State Loan Program) were established to find ways to assist dam owners in fi-


Albeni Falls Dam, Idaho

nancing dam repairs. The Committee to Develop a National Dam Repair Revolving Loan Fund has collected data on the costs to rehabilitate dams and has entered the data into a formula to determine a national rehabilitation cost. ASDSO will work with ASCE Legislative Affairs in writing a national loan/grant program for the rehabilitation of dams. ASDSO also will assist in the development of the Model State Revolving Loan Fund. Both projects are scheduled for completion in early 2002.

Conferences and technical seminars sponsored by ASDSO during FY 2000-2001 include conferences and seminars for all of the ASDSO regions and the 2000 annual ASDSO conference held in Providence, Rhode Island and the 2001 annual conference held in Snowbird, Utah. ASDSO also sponsored "Tailings Dams 2000," a joint specialty conference with the USSD in 2000.

In FY 2000-2001, ASDSO completed a number of educational tools for the states, including *Suggested References for State Dam Safety Programs* and a public awareness brochure/media kit entitled *Dam Safety: A National Concern*. For its Dam Owner Education Coordinators Project, ASDSO is developing a curriculum (trainer and participant handbooks, CD's, and brochures) and will train a team of presenters to hold dam owner training sessions in the states. The pilot program will begin in January 2002 with three pilot workshops.

ASDSO was an active participant in National Dam Safety Day, held on May 31, 2000 in Washington, D.C. ASDSO distributed a press release to 10,000 newspapers nationwide, and several states held local events or sponsored a statewide awareness day declared by Governor's proclamation.

The United States Society on Dams

The USSD, formerly the United States Committee on Large Dams, was established in the early 1930's and is the pre-eminent nationwide professional organization that focuses on dams and water resources development. USSD represents the United States as one of the 82 member countries of the International Commission on Large Dams (ICOLD) and is a member of the National Dam Safety Review Board. USSD is dedicated to:

- Advancing the technology of dam engineering, construction, operation, maintenance, and safety;
- Fostering socially, environmentally, and financially responsible water resources projects; and
- Promoting public awareness of the role of dams in the beneficial and sustainable development of the Nation's water resources.

The organization is comprised of a 12-member Board of Directors and 18 technical committees. The technical committees develop guidelines and technical criteria for use in the United States. USSD publications include technical bulletins and proceedings of Annual Lectures and specialty conferences and workshops. USSD members also participate on ICOLD committees for the development of international guidelines that are widely used by governments and organizations such as the World Bank.

USSD technical committees address all aspects of dam engineering, including safety, planning, design, and construction. Since its inception, USSD has either participated in or taken the lead in many important aspects of dam safety. These activities are coordinated nationally and internationally, and many aspects are consistent with the National Dam Safety Program.

Within the USSD organization, membership on the technical committees is comprised of representatives from engineering consulting firms, federal and state dam safety agencies, academia, construction companies, and individual consultants. During 2000 and 2001, USSD committees continued to develop technical guidance, a compendium of experiences in engineering and dam safety, including information on earthquakes, floods, and other natural disaster considerations, and to issue technical publications on all aspects of dam safety. To apprise the public about water resource development and the importance that dam safety plays in maintaining the Nation's water resources, USSD, in cooperation with FEMA, ASDSO and others, completed a video on the benefits of dams, *Water and Dams in Today's World*, through its Committee on Public Awareness. USSD also is developing white papers on topics such as risk assessment/evaluation, the use and importance of the National Performance of Dams Program, and the economic benefits of water resources developments. All of these tasks are coordinated and integrated into the National Dam Safety Program.

Other activities conducted by USSD in FY 2000 and 2001 are as follows:

- Annual Lecture 2000 – "Dam D&M Issues – The Challenge of the 21st Century"
- Annual Lecture 2001 – "The Future of Dams and Their Reservoirs"
- Participation in the 20th ICOLD Congress in 2000 in Beijing and the ICOLD Symposium on Concrete-Faced Rockfill Dams
- Participation in the 69th Annual Meeting of ICOLD, the Symposium on the "Benefits and Concerns About Dams" and the Workshop "Modern Techniques for Dams – Financing Construction, Operation, Risk Assessment" in Dresden, 2001

Other Partners in Dam Safety

There are many national and international organizations with interests in dam safety. Other organizations include:

- American Consulting Engineers Council
- American Planning Association
- American Red Cross
- American Society of Civil Engineers
- Associated General Contractors of America, Inc.
- Association of State Floodplain Managers
- Earthquake Engineering Research Institute
- Electric Power Research Institute
- The Hazard Mitigation Institute
- Institute for Business and Home Safety
- International City/County Managers Association
- International Association of Emergency Managers
- National Association of Counties
- National Conference of State Legislatures
- National Emergency Management Association
- National Hazards Research and Applications Information Center
- National Public Works Association
- National Society of Professional Engineers
- National Watershed Coalition
- Public Risk Management Association
- Water Environment Federation

- Published "Updated Guidelines for Selecting Seismic Parameters for Dam Projects," 1999
- Published "Observed Performance of Dams During Earthquakes," Volume I and Volume II, 2001
- Published "Aging of Dam Foundations," 2001
- Provided an official USSD response to the World Commission on Dams (WCD) Report, "A New Framework for Decision-Making." USSD expressed concern that the WCD Report concentrated on the shortcomings in the planning and decision process for dams and made little mention of the benefits derived from dams

THE NATIONAL DAM SAFETY PROGRAM IN FY 2000-2001

The National Dam Safety Program Act

On October 12, 1996, the Water Resources Development Act of 1996 (Public Law 104-303) was signed into law. Section 215 of Public Law 104-303 established a National Dam Safety Program and named the Director of the Federal Emergency Management Agency (FEMA) as its coordinator.

Purpose

The purpose of the National Dam Safety Program, as expressed in Section 215(a) of Public Law 104-303, is to "reduce the risks to life and property from dam failure in the United States through the establishment and maintenance of an effective national dam safety program to bring together the expertise and resources of the federal and non-federal communities in achieving national dam safety hazard reduction."

Objectives

The objectives of the National Dam Safety Program are to:

1. ensure that new and existing dams are safe through the development of technologically and economically feasible programs and procedures for national dam safety hazard reduction;
2. encourage acceptable engineering policies and procedures to be used for dam site investigation, design, construction, operation and maintenance, and emergency preparedness;
3. encourage the establishment and implementation of effective dam safety programs in each state based on state standards;
4. develop and encourage public awareness projects to increase public acceptance and support of state dam safety programs;
5. develop technical assistance materials for federal and non-federal dam safety programs; and
6. develop mechanisms with which to provide federal technical assistance for dam safety to the non-federal sector.

Initiatives

Public Law 104-303 directs FEMA to carry out a number of initiatives. These initiatives are summarized below:

1. Establish the Interagency Committee on Dam Safety;
2. Exercise leadership by chairing the Interagency Committee on Dam Safety to coordinate federal efforts in cooperation with state dam safety officials;
3. Transfer knowledge and technical information among the federal and non-federal elements;
4. Provide for the education of the public, including state and local officials, in the hazards of dam failure and related matters;
5. Provide funding to the states to establish and maintain dam safety programs through a grant assistance program;
6. Provide training for state dam safety staff and inspectors;
7. Establish a National Dam Safety Review Board to monitor state implementation of Section 215 and advise FEMA on implementation of the Program;
8. Establish a program of technical and archival research to develop improved techniques, historical experience, and equipment for rapid and effective dam construction, rehabilitation, and inspection, and devices for the continued monitoring of the safety of dams. FEMA also will provide for state participation in research and periodically advise all states and Congress on the results of the research;
9. Report to Congress on the availability of dam insurance and make recommendations on greater availability; and
10. Report to Congress (biennially) on the status of the Program, the progress achieved by federal agencies during the two preceding fiscal years in implementing the *Federal Guidelines for Dam Safety*, and the progress achieved in dam safety by states participating in the Program. The Report to Congress also will include recommendations for legislative or other action that the Director of FEMA considers necessary to achieve Program goals and objectives.

State Accomplishments

Overview

The state assistance program is intended to help states bring the necessary resources to bear on inspection, classification, and emergency planning for dam safety. Public Law 104-303 provides for the assistance program described below.

For a state to be eligible for primary assistance under the National Dam Safety Program, the state dam safety program must be working toward meeting the following criteria, as listed in Public Law 104-303:

- The authority to review and approve plans and specifications to construct, enlarge, modify, remove, and abandon dams;
- The authority to perform periodic inspections during dam construction to ensure compliance with approved plans and specifications;
- A requirement that state approval be given on completion of dam construction and before operation of the dam;
- The authority to require or perform the inspection at least once every 5 years of all dams and reservoirs that would pose a significant threat to human life and property in case of failure to determine the continued safety of the dams and reservoirs, and a procedure for more detailed and frequent safety inspections;
- A requirement that all inspections be performed under the supervision of a state-registered professional engineer with experience in dam design and construction;
- The authority to issue notices, when appropriate, to require owners of dams to perform necessary maintenance or remedial work, revise operating procedures, or take other actions, including breaching dams when necessary;
- Regulations for carrying out the legislation of the state;
- The provision for funds to ensure timely repairs or other changes to or removal of a dam to protect human life and property, and if the owner of the dam does not take the action described above, to take appropriate action as expeditiously as possible;

TABLE 2
STATE GRANT AMOUNTS FOR FY 2000-2001

STATE	FY 2000/2001 AWARDS (in combined $)
Alabama*	26,117
Alaska	58,788
Arizona	68,204
Arkansas	82,066
California	146,628
Colorado	170,810
Connecticut	105,420
Delaware*	26,117
Florida	95,400
Georgia	331,046
Hawaii	61,952
Idaho	84,326
Illinois	147,004
Indiana	139,622
Iowa	282,304
Kansas	525,182
Kentucky	129,074
Louisiana	75,588
Maine	100,072
Maryland	80,862
Massachusetts	170,282
Michigan	102,858
Minnesota	115,966
Mississippi	309,726
Missouri	98,942
Montana	267,992
Nebraska	206,218
Nevada	82,444
New Hampshire	113,480
New Jersey	173,748
New Mexico	86,512
New York	199,060
North Carolina	376,548
North Dakota	94,572
Ohio	182,562
Oklahoma	390,184
Oregon	140,902
Pennsylvania	145,574
Puerto Rico	54,938
South Carolina	221,208
South Dakota*	111,584
Tennessee	96,078
Texas	561,568
Utah	92,162
Vermont	77,696
Virginia	88,998
Washington	91,936
West Virginia	75,588
Wisconsin	125,006
Wyoming	154,614

*FY 2000 dollars only; FY 2001 funds were awarded to 19 states that requested unused grant funds.

TABLE 3
PERCENT OF EAP'S BY STATE-REGULATED HIGH- AND SIGNIFICANT-HAZARD POTENTIAL DAMS

STATE	FY 98-99 PERCENT	FY 00-01 PERCENT	% CHANGE
Alabama*			
Alaska	14	19	+5
Arizona	53	75	+22
Arkansas	27	33	+6
California	10	28	+18
Colorado	95	99	+4
Connecticut	42	42	0
Delaware*			
Florida	0	89	+89
Georgia	1	.04	-.06
Hawaii	7	4	-3
Idaho	43	70	+27
Illinois	47	48	+1
Indiana**		3	n/a
Iowa	0	0	0
Kansas	3	7	+4
Kentucky	.05	1	+.05
Louisiana	5	5	0
Maine	5	22	+17
Maryland	39	63	+24
Massachusetts	3	14	+11
Michigan	52	62	+10
Minnesota	17	17	0
Mississippi	7	4	-3
Missouri	5	7	+2
Montana	43	43	0
Nebraska	29	30	+1
Nevada	6	13	+7
New Hampshire	65	70	+5
New Jersey	35	46	+11
New Mexico	0	1	+1
New York	14	18	+4
North Carolina	6	7	+1
North Dakota	0	1	+1
Ohio	9	15	+6
Oklahoma	55	58	+3
Oregon	22	23	+1
Pennsylvania	9	18	+9
Puerto Rico	3	32	+29
Rhode Island	0	0	0
South Carolina	90	90	0
South Dakota	35	17	-18
Tennessee	42	37	-5
Texas	.04	.06	+.02
Utah	45	47	+2
Vermont	17	0	-17
Virginia	100	96	-4
Washington	36	30	-6
West Virginia	58	49	-9
Wisconsin	14	21	+7
Wyoming	17	19	+2

*Did not submit data for 98-99 or 00-01.
**Did not submit data for 98-99.

- A system of emergency procedures to be used if a dam fails or if the failure of a dam is imminent; and
- An identification of each dam whose failure could be reasonably expected to endanger human life, the maximum area that could be flooded if the dam failed, and public facilities that would be affected by the flooding.

For a state to qualify for primary assistance, state appropriations must be budgeted to carry out the legislation of the state.

Scope of State Assistance
For FY 2000 and FY 2001, FEMA allocated all state assistance funds under the primary assistance criteria of Public Law 104-303. Table 2 lists the state assistance grant amounts (combined) for FY 2000-2001.

Highlights in FY 2000-2001
FY 1998-1999 was the first period for which the states provided FEMA with data on the number of dams in their states by hazard classification; the number of dam inspections conducted each year; remediation needs; and the status of dams with Emergency Action Plans (EAP's) by hazard classification. Table 3 compares by state the percent of EAP's by state-regulated high- and significant-hazard potential dams for FY 1998-1999 against the data provided for FY 2000-2001. On average, the states improved by 7 percent the number of state-regulated high- and significant-hazard potential dams with EAP's. (It should be noted that in the case of some states, federal funding represents a small percentage of the state's overall funding for dam safety.)

The number of dam inspections conducted by the states also increased dramatically since data was first collected for 1998-1999, from a total of approximately 13,000 inspections for 1998-1999 to 16,000 inspections for 2000-2001, an increase of 25 percent. Data from these two critical areas demonstrate that dam safety has improved in the United States over the last 4 years as a result of the National Dam Safety Program Act.

Each step on the road to dam safety is a success, and all of the states that have received Na-

tional Dam Safety Program grant funds in FY 2000-2001 have achieved successes, whether it be through activities such as an increase in emergency action planning and inspections, public and dam owner awareness programs, or increased enforcement of state dam safety laws and regulations.

The following are selected success stories from 12 states that highlight accomplishments with National Dam Safety Program funds in FY 2000 and 2001.

Alaska: Focus on Emergency Action Planning
In 1999, there were 42 high- and significant-hazard potential dams in Alaska under state jurisdiction that required an EAP. However, only 10 EAP's were on file with the Alaska Department of Natural Resources, including one for a low-hazard potential dam. None of the EAP's was current in 1999. The poor level of compliance posed an unacceptable risk to the downstream communities.

Performance measures presented to the state legislature for the Dam Safety and Construction Unit budget included the annual exercise of EAP's. However, as Alaska dam safety regulations do not require the exercise of EAP's, the Dam Safety and Construction Unit chose to use funds from the National Dam Safety Program to raise awareness and provide training opportunities to dam owners and operators, consultants, and emergency managers.

Instructors from the Illinois Department of Natural Resources and the Illinois Emergency Management Agency conducted the EAP for Dams Development Course developed by FEMA in 1996, and personnel from the Federal Energy Regulatory Commission (FERC) presented the EAP Exercise Design Course in Anchorage in October 2000. The October 2000 course was attended by 25 students, including dam owners and operators, consultants, and emergency response managers. In one case, the owner of a high-hazard potential dam was able to build a relationship with the local emergency managers, which is leading to the development of a revised EAP with a new inundation map. Four current EAP's are now on file with the state, and at least three more are under revision.

Colorado: Equipment for Risk Assessment Methodology
With National Dam Safety Program funds, engineers in Colorado now have the hardware and software to do their jobs better, as well as the training to use the tools effectively. The hard-

Hannibal Locks & Dam, Ohio

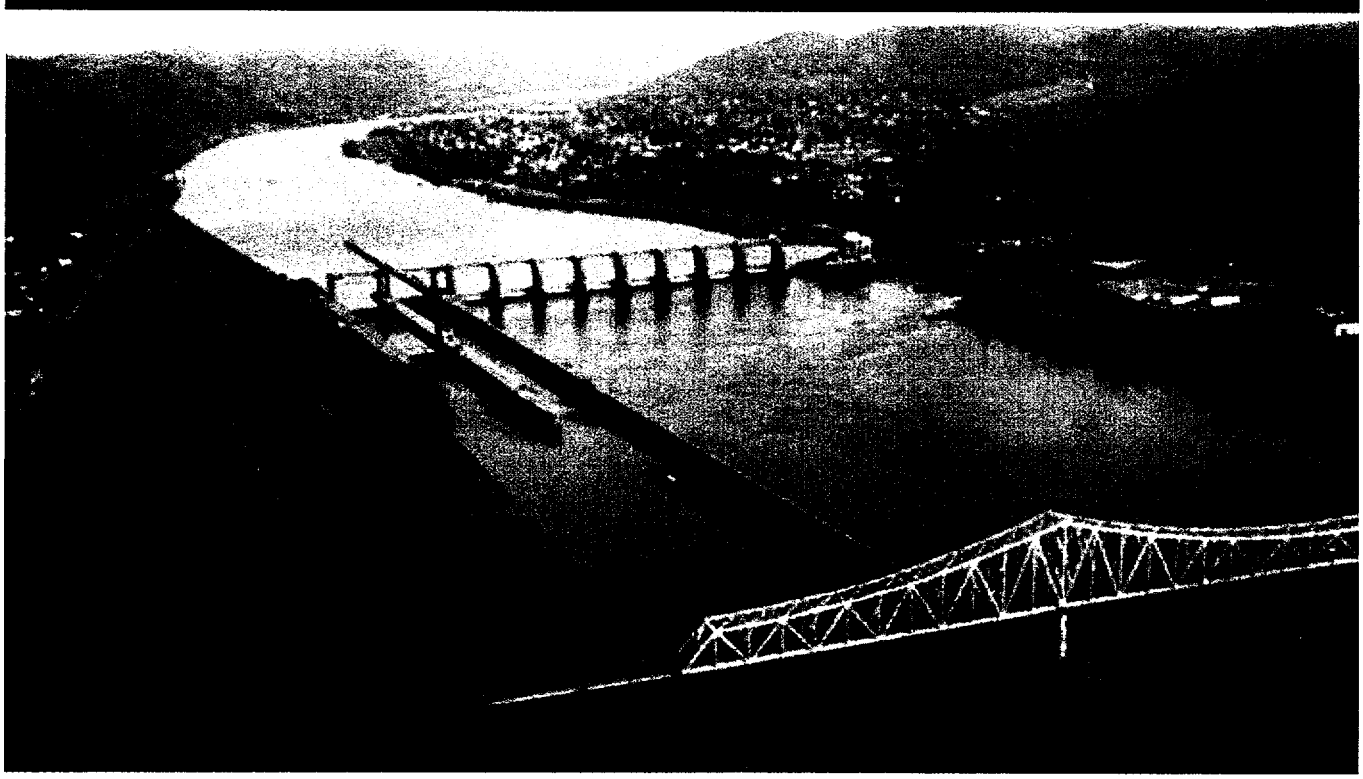


TABLE 4
SUMMARY STATUS OF DAMS BY STATE

STATE	NATIONAL INVENTORY				STATE REGULATED			
	Total	Hazard Classification			Total	Hazard Classification		
		High	Sig.	Low		High	Sig.	Low
Alabama**								
Alaska	112	22	31	59	81	16	25	40
Arizona	322	106	77	139	269	88	51	130
Arkansas	1223	167	212	844	402	102	93	207
California					1240	395	530	315
Colorado	1666	296	323	1047	1714	264	292	1158
Connecticut	706	226	452	28	706	226	452	28
Delaware**								
Florida	773	99	259	415	773	99	259	415
Georgia	4250	450		3800	3692	372		3320
Hawaii	131	55	13	63	131	55	13	63
Idaho	364	99	128	137	466	104	151	211
Illinois	1261	169	275	817	1311	169	275	867
Indiana					1160	241	249	670
Iowa	3259	75	176	3008	3235	68	174	2993
Kansas	5601	153	338	5110	6395	191	316	5888
Kentucky	1133	302	241	590	1026	173	209	644
Louisiana	287	11	46	230	287	11	46	230
Maine	751	66	186	499	621	21	131	469
Maryland	275	59	76	140	343	59	76	208
Massachusetts	1453	322	743	388	2866	334	743	1789
Michigan	1134	134	155	845	1043	81	144	818
Minnesota	960	40	150	770	859	29	140	690
Mississippi	3511	272	72	3167	3512	273	72	3167
Missouri	4095	607	912	2576	630	440	127	63
Montana	2616	97	121	2398	2867	97	126	2644
Nebraska	2115	101	245	1769	2115	101	245	1769
Nevada	429	126	118	185	419	121	115	183
New Hampshire	640	86	207	347	818	86	192	540
New Jersey	812	189	357	266	1660	189	407	1064
New Mexico	537	174	73	290	358	144	65	149
New York	1919	377	779	763	1919	377	779	763
North Carolina	2483	1055	379	1049	4659	994	666	2999
North Dakota	772	27	92	653	722	18	86	618
Ohio	1713	478	551	684	1713	478	551	684
Oklahoma	4511	183	88	4240	4388	143	78	4167
Oregon	828	122	181	525	1191	122	181	888
Pennsylvania	1411	811	209	391	1241	738	197	306
Puerto Rico	35	34		1	35	34		1
Rhode Island	510	16	41	453	510	16	41	453
South Carolina	2317	190	467	1660	2241	148	458	1635
South Dakota	2409	84	155	2170	2269	51	144	2074
Tennessee	1045	212	315	518	610	152	200	258
Texas	7413	854	779	5780	7413	854	779	5780
Utah	631	214	210	207	621	185	208	228
Vermont	346	52	134	160	346	52	134	160
Virginia	1598	148	268	1182	514	110	124	280
Washington	694	186	207	301	556	117	186	253
West Virginia	310	238	61	11	320	245	65	10
Wisconsin	1081	202	200	679	966	146	172	648
Wyoming	1310	96	105	1109	1378	83	110	1185

*State-regulated dams. **Not participating in NDSP grant program.

DAM INSPECTIONS*				DAMS WITH EAP'S*	
Total	Hazard Classification			High	Sig.
	High	Sig.	Low		
9	1	2	6	5	3
138	77	31	30	66	38
315	102	92	121	65	
1240	395	530	315	176	87
651	248	203	200	262	287
44	34	9	1	160	126
1131	198	518	415	99	220
1079	386		693	15	
41	25	6	10	3	
209	33	67	109	75	33
130	69	33	28	118	95
303	71	52	180	16	
48	24	16	8	36	
260	77	84	99	4	
108	10	46	52	2	1
95	2	30	63	14	20
138	56	28	54	54	31
403	122	94	187	95	54
187	28	23	136	60	80
99	29	10	60	29	
122	102	4	16	14	
204	167	25	12	25	15
11	11			95	
432	56	81	295	97	6
260	120	40	100	23	7
185	26	51	108	78	121
451	75	210	166	159	117
55	41	4	10	7	1
444	185	158	101	171	34
1764	688	353	723	101	17
154	13	59	82	1	1
340	93	117	130	81	74
1114	139	75	900	124	4
342	122	63	157	59	10
787	398	55	334	125	41
11	11			11	
26	16		10		
298	148	150		133	410
81	17	6	58	33	
405	147	107	151	127	2
410	149	247	14	7	
255	105	104	46	103	
48	18	20	10		
220	59	61	100	105	119
317	72	37	208	72	20
223	223			148	3
26	2	4	20	35	31
226	15	26	185	33	4

ware and software will be used in the near future to conduct the analyses for a risk assessment methodology. The next area of training for Colorado dam safety staff will be risk assessment. Colorado also is gearing up for dam owner training, which will include emergency preparedness.

Florida: Annual Training Course
National Dam Safety Program funds are being used in Florida to sponsor an annual training course for a variety of government employees who deal with dam safety. Florida also has used the funds to improve the state dam inventory and to convene annual state conferences on dam safety. Equipment purchased with grant funds, including a digital camera and laptop computer, has enhanced the ability of state personnel to inspect and report problems in a more rapid and concise manner.

Illinois: Updating EAP's, Assisting Other States, and Conducting an EAP Drill
Plans to address emergency operations at dams have been a part of the Illinois permit program for dams for more than 20 years. Over the last few years, Illinois has worked with the owners of proposed new dams and those dams that had emergency operation plans to update and improve the plans based on the format provided in the *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*. Representatives from the Illinois dam safety and emergency management offices have conducted EAP training courses for dam owners, their engineers, and for emergency services personnel. The course presentations have included representative dam owners to assist other owners in understanding the importance of the EAP's. This team also traveled to Alaska to assist in conducting an EAP for Dams Development Course.

Funds from the National Dam Safety Program also were used to conduct a drill of an EAP for a dam in the northwest portion of the state. The drill involved emergency responders, who notified potentially impacted residents and then debriefed with emergency management personnel and the dam owner to improve the EAP. These efforts assist the entire community around the dam to understand the part they play in assuring the safety of residents during an incident at the dam.

Maryland: Savage River Dam
The Savage River Dam in Western Maryland has a very large dam failure inundation area along the Potomac River that includes about 4,000 homes, businesses and schools, 2 prisons, and numerous highways and bridges. The failure of the dam would cause major flooding of several towns along the Potomac River within 30 minutes. While developing an EAP for the dam, it became apparent that notifying such a large number of properties that would suffer damage in the event of a dam failure presented an enormous challenge.

The Savage River Dam Emergency Planning Committee, a diverse coalition of public and pri-

Savage River Dam, Maryland

vate organizations, determined that an automated call-down system was needed to complete the large number of early notification calls in a very short period of time. The development of a call-down system to provide early notification to individuals and properties at risk in the event of the failure of the Savage River Dam illustrates the benefits of developing partnerships that reduce community risk and provide emergency preparedness. Additional benefits of the call-down system include the ability to program multiple subsets of names and telephone numbers for other emergency events, such as flooding, severe weather events, and hazardous waste spills.

Massachusetts: Model for the Operation and Maintenance of a Dam

Funding from the National Dam Safety Program presented a unique opportunity in Massachusetts to both solve a specific dam problem and to create dam safety awareness on a statewide basis. When completed, the project will serve as a state model on how to operate and maintain a dam.

The Ashland Reservoir Dam is a large high-hazard potential dam located about 30 minutes west of Boston and immediately upstream from the center of Ashland. The dam, which is currently used for recreation, has suffered from years of neglect and lack of maintenance due to the lack of funding and staff to maintain the dam. In addition, there was no EAP in place in the event of a dam failure. It also was discovered that the command center, evacuation route, and emergency shelter for the town of Ashland were directly in the path of the flood wave.

The Ashland Reservoir Dam Project has a number of components. An inspection describing all of the deficiencies that need to be addressed has been completed, along with cost estimates to complete an EAP and an Operations and Maintenance Manual for the dam. The project also includes the development of a video simulating the dam failure. The video is time sequenced to show the center of downtown Ashland being hit by a flood wave, and the resulting Inundation Map that changes over time. For public television, a joint presentation on "Dam Safety Awareness" using the story of the Ashland Reservoir Dam and the video simulation will be developed.

Missouri: Access to Remote Sites

Missouri has purchased a remote-controlled pipe crawler/camera with National Dam Safety Program funds to use in inspecting pipes in dams. The camera is mounted on an all terrain vehicle (also purchased with grant funds), which enables access to remote sites. At the Lake Alpine Dam, the camera was used to detect a separated joint on a drainpipe that passed through the foundation of the 118-feet tall earth dam. Detection and remediation of the defect averted serious damage to the dam and possible dam failure.

Montana: High-Hazard Dam Owner Awareness Program

National Dam Safety Program funds were used in Montana to initiate a statewide program to increase dam owner awareness on the importance of dam maintenance. A secondary objective of the program was to work with both dam owners and disaster and emergency services personnel to review and update EAP's and operation and maintenance plans. Engineers in seven regional offices met with all dam owners in their areas to assist the dam owners in conducting the annual owner inspection of the dam. At that time, the engineers identified maintenance needs at the dam. One significant outcome of the project was the assurance that the operation, maintenance, and EAP for every high-hazard potential dam were up-to-date. In addition, all high-hazard potential dam owners received training on how to properly conduct the required annual owner's inspection, with particular attention to maintenance needs. As a result, there is now an increased awareness among Montana's dam owners of the importance of proper operation and timely maintenance.

Nevada: Technology Helps Staff in Inspections

Nevada has 577 dams in its inventory and only two full-time equivalent (FTE) personnel to administer the program. The State's policy is to inspect all high-hazard structures annually, significant-hazard structures every 3 years, and low-

hazard structures every 5 years. Because of the small ratio of FTE's to the number of dams requiring inspections, it is extremely difficult for Nevada to inspect its dams according to schedule. As a result of National Dam Safety Program funds, Nevada has purchased state-of-the-art equipment, software, and training that are providing dam safety personnel with the tools to do a better and more efficient job. Nevada also has been able to contract with a firm to conduct dam inspections, an extremely important benefit of the grant funding.

New Hampshire: Dam Safety Emergency Response Database

In the 1990's, there were several disasters in New Hampshire, including a fatal dam failure and several instances of damaging flooding. In response to the disasters, the state's emergency responders identified the need for real-time access to information on all dams to enable them to respond to events in a timely manner and reduce damages. The New Hampshire Department of Environmental Services Dam Bureau used the majority of its initial grant funds to develop a transportable computer database of information for response to dam-related emergencies. During emergencies, the database can be transported to the state's Emergency Operation Center and to the field to assist on-site emergency responders.

The database includes information on each of the state's 4,800 dams. For each of the 283 significant- and high-hazard potential dams in the state, the database includes photographs; data on construction and dimensions; discharge and storage capacities; digitized inundation maps developed as part of the EAP's required for each dam; and information on the potential flood wave height and time at downstream damage centers. With this critical information, the Dam Bureau staff, local officials, and other emergency responders can respond quickly and effectively to dam-related emergencies.

Ohio: Compliance with State Dam Safety Requirements

Ohio has used its National Dam Safety Program funds to focus on increased enforcement of its dam safety laws and administrative rules. Although Ohio has had enforcement authority for a number of years, the State has not been able to take legal action on a number of projects because of time and money constraints. For example, the lack of adequate resources for proper enforcement of state dam safety laws has resulted in several dams in Ohio being built without proper construction permits. Improper dam design and inadequate testing and supervision during construction may have occurred, which could cause some of the dams to be unsafe and pose an unnecessary risk to downstream lives and property. Many older dams also need to be upgraded to meet current safety standards, and enforcement action is needed to require dam owners to make the necessary repairs.

National Dam Safety Program funds will allow Ohio to develop and document a process for enforcement. The process will be used to determine those dams that should be targeted for enforcement action and to ensure that the enforcement measures are applied on a consistent basis to all dams. As a result of the grant funding, Ohio can provide better protection to its citizens against the potential loss of lives and property caused by dam failures.

Oklahoma: Investment in Technology

Oklahoma is second in the Nation in the number of dams per FTE. When National Dam Safety Program funds first became available, Oklahoma developed a long-range plan to invest in state-of-the-art technology to allow the state to adequately care for aging dams and reservoirs without an increase in personnel. Oklahoma dam safety field offices are now equipped with digital cameras, laptop computers, and color printers to assist with dam safety inspections. With the new technology, a problem in the field can be photographed and sent to qualified staff for review, resulting in great savings in time and personnel. With High Accuracy Global Positioning System (GPS) survey equipment and the Robotic Total Station, also purchased with National Dam Safety Program funds, Oklahoma can now more efficiently obtain accurate cross-section data for breach inundation mapping. The survey data

will be used with upgraded breach inundation mapping software to develop Geographic Information System (GIS)-driven inundation maps that will be furnished to emergency managers in the areas downstream of Oklahoma high-hazard potential dams.

Research

Research is critical to the Nation's agenda for dam safety. Under the National Dam Safety Program Act, research funding has addressed a cross-section of issues and needs in FY 2000 and 2001, all in support of ultimately making dams in the United States safer. An important component of the research program is the focus on the sharing of research between the federal and state sectors.

In April 1999, the first full year of Program funding, a list of research needs and priorities for dam safety was developed. The priorities included outlets/gates, spillways, hydrologic model analysis, dam failure analysis, risk analysis, overtopping, and seismic analysis. Since that time, the Research Subcommittee has sponsored a series of workshops in these areas, and identified priorities for additional workshops. As information has become available from the workshops, laymen's guides, expert level guides, and research workshop summaries have been produced. An important element of the research program is the integration of research results into training at the National Emergency Training Center (NETC) and via other sites and programs.

Over the next 5 years, the partners in the National Dam Safety Program will develop a long-term plan to identify and address research needs; to advance the state-of-the-practice; and to prototype successful activities, such as the research workshops, training, and expert level documentation. A primary strategy for the research program will be to broaden outreach and partnering efforts to agencies such as the United States Geological Survey, the National Science Foundation, and the National Weather Service, and to universities and the private sector.

Below are summaries of some of the projects sponsored with research funds under the National Dam Safety Program. A description of the Dam Safety Program Management Tools (DSPMT) program and the National Performance of Dams Program (NPDP), both of which received research funding in FY 2000 and 2001, can be found in this section under *Information Technology*.

ACCOMPLISHMENTS WITH STATE ASSISTANCE FUNDS IN FY 2000-2001

- Dam safety-related training for state personnel and training in the field for dam owners
- Purchase of equipment, including state-of-the-art computer systems and software; new equipment to aid in engineering analysis; video inspection cameras to inspect conduits through dams; laptop computers for use in the field to complete inspection reports and other correspondence; and surveying equipment
- Increase in the number of dam inspections
- Increase in the number of EAP's filed with the states
- Increase in the turnaround time on the review and issuance of permits
- Improved coordination with state emergency preparedness officials
- The testing of EAP procedures through actual simulations of dam failures
- Improvements to dam inventory databases
- Improved telecommunications
- Identification of dams to be repaired or removed
- Updating of operations and maintenance manuals and handbooks
- Conduct of dam safety awareness workshops for dam owners on preparing EAP's
- Development of a proposed set of modifications to strengthen dam safety rules
- Creation of dam safety videos, educational flyers, and other outreach materials
- Development of dam safety newsletters and press releases

Dam Seepage Monitoring System
Completed with research funding, the Dam Seepage Monitoring System is an interactive tool that is designed to help dam owners and operators store instrument measuring data on their personal computers and to transfer that information to state dam safety offices for evaluation, thereby improving the safety of their dams. The Dam Seepage Monitoring System is available at no cost from FEMA.

Research Workshops
A number of research workshops were sponsored with National Dam Safety Program funds in FY 2000-2001. Co-sponsors of the workshops included ASDSO, the Electric Power Research Institute (EPRI), Utah State University, the Agricultural Research Service (ARS), and the United States Army Corps of Engineers (Corps). Research workshops sponsored with Program funds in FY 2000 and 2001 included:

- Issues, Remedies, and Research Needs on Animal and Vegetation Invasion of Dams (November 29-December 2, 1999, Knoxville, Tennessee, Organized and Conducted by ASDSO)
- Issues, Remedies, and Research Needs Related to Gate Structures on Dams (January 5-7, 2000, Palo Alto, California, Organized and Conducted by ASDSO and EPRI)
- Issues, Remedies, and Research Needs Related to Risk Analysis & Risk Assessment (March 7-9, 2000, Logan, Utah, Organized and Conducted by ASDSO and Utah State University)
- Issues, Remedies, and Research Needs Related to Seismic Issues for Dams (August 8-9, 2000, Denver, Colorado, Organized and Conducted by the Corps)
- Issues, Remedies, and Research Needs Related to Seepage through Dams (October 17-19, 2000, Denver, Colorado, Organized and Conducted by ASDSO and URS Greiner Woodward Clyde)
- Issues, Remedies, and Research Needs Related to Dam Failure Analyses (June 26-28, 2001, Oklahoma City, Oklahoma, Organized and Conducted by the ARS of the United States Department of Agriculture)

The first research workshop for FY 2002, Issues, Remedies, and Research Needs Related to Hydrologic Issues, will be held in November 2001 in Davis, California.

Research Workshop Reports and Other Products
Reports from the research workshops assist the Research Subcommittee and other groups in reviewing recommendations and developing a strategy for extending the state-of-the-practice. The following research reports were completed in FY 2000-2001.

- *Spillways Gate Workshop Report*
- *Specialty Workshop on Risk Assessment for Dams Report*
- *A Workshop on Issues, Solutions, and Research Needs Related to Seepage through Embankment Dams*
- *Issues, Remedies, and Research Needs on Animal and Vegetation Invasion on Dams*

An important need agreed to by the participants at the Specialty Workshop on Conduits and Other Penetrations Through Dams (held at Virginia Tech University) was a layman's pamphlet on piping problems in earth dams. The pamphlet developed by ASDSO, *Responsibilities of Dam Ownership: Internal Erosion of Dams*, explains to dam owners and others the state-of-the-practice relating to conduits through dams, as well as the potential problems relating to piping in dams and their foundations, particularly along conduits through the embankments. Distribution by ASDSO included all of the state dam safety agencies, which in turn distributed the brochure to dam owners in their states.

Other products scheduled for completion next year by ASDSO include a Laymen's Guide on Plant Invasion through Dams and a Laymen's Guide on Animal Invasion through Dams.

Bibliography of Dam Safety Practices
To launch an effective and efficient research program, the Research Subcommittee recommended that all relevant research data be collected and compiled on the history of dam safety engineering in the major technical areas. To address this need, ASDSO developed a comprehensive *Bibliography of Dam Safety Practices*, using its national

networking capabilities to gather information and develop an in-house library of resources. The effort, which began in 1999, continues today. The *Bibliography*, which is updated on a weekly basis, is housed at ASDSO and is fully searchable online at www.damsafety.org.

Training

Since the inception of the National Dam Safety Program in 1979, FEMA has supported a very strong, collaborative training program for both dam safety professionals and dam owners. With the training funds provided under the 1996 Act, FEMA has been able to expand existing training programs, begin new initiatives to keep pace with evolving technology, and enhance the sharing of expertise between the federal and state sectors. Training activities conducted in FY 2000-2001 are described below.

Regional Technical Seminars and State Training Assistance

For many years, ASDSO has been FEMA's most important partner in the National Dam Safety Program. With the funding that has been made available under the 1996 Act, FEMA has been able to increase its support for ASDSO-sponsored training programs. Each year, in addition to its annual conference, ASDSO conducts six regional technical seminars on topics such as tailings dams, stability analysis of embankment dams, and hydrology and dam safety. Training funds from the National Dam Safety Program are set aside for the attendance of state officials at these events.

Each year, an amount also is provided to each state dam safety official so that the official can attend the training of his or her choice. This flexibility allows the states to focus training on their specific needs.

National Dam Safety Program Technical Workshop Series

A major training initiative is the National Dam Safety Program Technical Workshop Series. The idea for a series of technical workshops originated with the Interagency Committee on Dam Safety (ICODS) in 1992. The goal then, as it is now, was to invite recognized authorities in the engineering field to discuss analysis techniques, construction methods, and other issues that can increase the expertise and information available to all of the engineers in the dam safety community. For the first few years of the Technical Workshop Series, the majority of attendees were representatives from federal agencies. With the passage of the 1996 Act, FEMA was able to make the Workshop Series more national in scope, and more inclusive of state and local dam safety personnel and the private sector.

For the last 3 years, training funds from the National Dam Safety Program have been set aside for state dam safety officials to attend the Workshops. To date, eight Technical Workshops have been held. In February 2001, over 300 people attended National Dam Safety Program Technical Workshop No. 8, Inspection, Evaluation, and Follow-Up, including representatives from 21 state dam safety agencies. The topic of Technical Workshop No.7, held in February 2000, was spillway gates. Technical Seminar No. 9, Responding to Dam Safety Emergencies, will be held at FEMA's Emergency Management Institute (EMI) on February 20-23, 2002.

HEC-RAS and HEC-HMS Training

HEC-RAS is the Corps Hydraulic Engineering Center (HEC) River Analysis System (RAS). The HEC-RAS software analyzes networks of natural and man-made channels and computes water surface profiles based on steady one-dimensional flow hydraulics. The HEC-HMS is the HEC Hydraulic Modeling System (HMS) designed to simulate the precipitation runoff processes of dendrite watershed systems. Training in both HEC-RAS and HEC-HMS has been a priority for state and federal training efforts. One course was developed and conducted on HEC-RAS in FY 2001 at FEMA's Mt. Weather facility and two courses (HEC-RAS and HEC-HMS) will be conducted in FY 2002.

Training Aids for Dam Safety

One of the most successful training initiatives is the Training Aids for Dam Safety (TADS) program, which consists of 21 modules covering topics from inspection to evaluation to emer-

gency planning. The TADS program consists of three parts: (1) the inspection component, in which state regulators are taught how to conduct a dam safety inspection; (2) the awareness component, which emphasizes dam safety mitigation; and (3) the analysis component, in which state regulators are taught how to analyze dam safety data. EMI is currently working on Web-based updates to two of the TADS modules: the inspection embankment dams module and the module on evaluation of seepage conditions. The TADS modules are used extensively by state dam safety personnel and the ICODS federal agencies.

Emergency Action Planning

Emergency action planning is a major initiative of the National Dam Safety Program, with a goal of 100 percent participation for all high- and significant-hazard potential dams. In early FY 2000, FEMA hosted a training production, broadcast by satellite and the Internet, on emergency action planning for dams. The production, which was broadcast on FEMA's EENet station, targeted dam owners and operators, dam safety officials, emergency managers, and the public. Information covered during the broadcast included the cost of an EAP and the resources available for development and testing. Videotapes of the broadcast are available through FEMA's National Dam Safety web site.

Information Technology

The spectrum of information needs extends from those in the Congress who set national priorities and allocate fiscal resources to those of the dam owner/engineer involved in inspections, operations and maintenance, dam safety modifications, and other day-to-day activities of maintaining safe, economically viable facilities and environmentally responsible structures. Given the rapid pace of technology, those in a leadership role must recognize and make the best use of tools to accomplish their objectives. A primary objective of FEMA in its leadership of the Program is to identify, develop, and enhance technology-based tools that can help educate the public and assist decision-makers.

National Inventory of Dams

The National Inventory of Dams (NID) is a computerized database of dams in the United States used to track information on our water control infrastructure. The primary source for disseminating the data is the Internet. The NID also includes Internet-based tools to query the data, and features a GIS interface that allows for the display and analysis of data. Access to the NID is available at http://www.tec.army.mil/nid/. The current NID contains over 77,000 dams. It is a dynamic on-line database with scheduled periodic updates and interim updates (as improved data is received from participants).

Information from the NID is used in the development of water resource management, land use management, flood plain management, risk management, and emergency action planning. The NID update process involves a partnership of 68 states, territories, and federal agencies, in coordination with the Corps, FEMA, and ASDSO.

Congress authorized the Corps to inventory dams in the United States with the National Dam Inspection Act (P.L. 92-367) of 1972. The NID was first published in 1975, and has been periodically updated thereafter. The Water Resources Development Act of 1986 (P.L. 99-662) authorized the Corps to maintain and periodically publish an updated NID, and Section 215 of the Water Resources Development Act of 1996 (P.L. 104-303) re-authorized periodic update and provided a continued funding mechanism.

These updates capture more accurate and more comprehensive data on existing dams, changes in existing dams, and new dams. For example, each dam in the NID is assigned a downstream hazard potential classification (by the appropriate regulating authority), based on the potential loss of life and damage to property should the dam fail. With the changes in demographics and post-construction land development in downstream areas, hazard potential classifications need to be updated continually to reflect the dam's current status.

The NID update process continues to improve, utilizing current technology and computer capabilities. The process assists and strengthens the ability of the states and federal agencies to main-

tain current and accurate information on dams, and to transmit that information to the NID. Software has been developed to help states and federal agencies compile information from their own databases on safety inspections, view data changes or deficiencies, and export NID data according to specifications for NID update. This software will enable data owners to assess the accuracy and completeness of their data and in re-formatting and quality assurance tasks. The goal of a joint project between the Corps and ASDSO is to develop a Palm Pilot inspection program for the states. The Corps is testing the program in selected states and, if successful, will distribute the Palm Pilots to the states in 2002.

As the update process continues, the quality of information at all levels in the Nation's dam safety community continues to improve. State inspections and data sharing among state and federal agencies will verify or amend existing data, and identify or complete missing information. The key advantages of this methodology are that it leverages the economic advantages of a partnership effort, fosters cooperation among state and federal agencies, and strengthens risk management and decision-making at the state and national level.

Data from the NID can be analyzed to provide decision-makers with statistical information such as the following:

- National development of water control infrastructure is shifting from a construction phase to a maintenance and rehabilitation phase.
- About 21 percent of the dams in the NID have a high- or significant-hazard potential classification. Downstream hazard potential classifications of high, significant, or low are assigned to each dam in the NID to identify the risk dams can pose due to failure or negligent operation.
- About 29 percent of the high- and significant-hazard potential dams nationwide have an EAP, as described by the *Guidelines*. These guidelines state that an EAP, commensurate with dam size and location, should be formulated for each dam. EAP's have been prepared for 60 percent of the dams with high-hazard potential, and 80 percent of dams with significant-hazard potential. With an increased risk of terrorism against our infrastructure, EAP's are even more critical than ever, and provide an additional measure of protection for downstream residents and dam owners.

In response to the terrorist attacks of September 11, 2001, an increased focus has been made on infrastructure protection nationwide. Appropriate measures to protect NID data are currently being investigated. Interim actions have been taken to limit public access to the data while permanent security measures are being developed.

National Performance of Dams Program

The NPDP is an effort by the dam safety community to retrieve, archive, and disseminate information on dams and their performance. The NPDP, which is headquartered at Stanford University where it was founded, was initially started with financial support provided by FEMA. Working with professional associations and federal agencies, the NPDP receives reports on dam incidents (events that relate to the structural and operational integrity of dams). The mission of the NPDP is to support public and private efforts to improve dam safety, dam design and rehabilitation, and the implementation of effective public policy. As part of its mission, the NPDP operates a database and library on the performance of dams to meet the needs of dam safety professionals. The NPDP home page is http://npdp.stanford.edu/.

Dam Incident Reporting and Data Gathering

For the 2-year period from 2000 – 2001 (through October 2001), over 600 Dam Incident Notifications, many of which report more than one dam incident, were reported to the NPDP by dam safety professionals. These notifications reported 24 dam failures involving a breach of the dam and uncontrolled release of the reservoir.

During this period, 25 states and 3 federal agencies have reported dam incidents to the NPDP. Currently, the program continues to work with ASDSO to improve the level of state reporting. These efforts have included visits to states to gather data and to facilitate state reporting ef-

forts. States that were visited include Washington, Ohio, and New Jersey. During these visits, the NPDP staff have obtained over 7,000 digital photographs from dam inspections and more than 300 digital periodic dam safety inspection reports. These documents will be incorporated into the NPDP digital library and database.

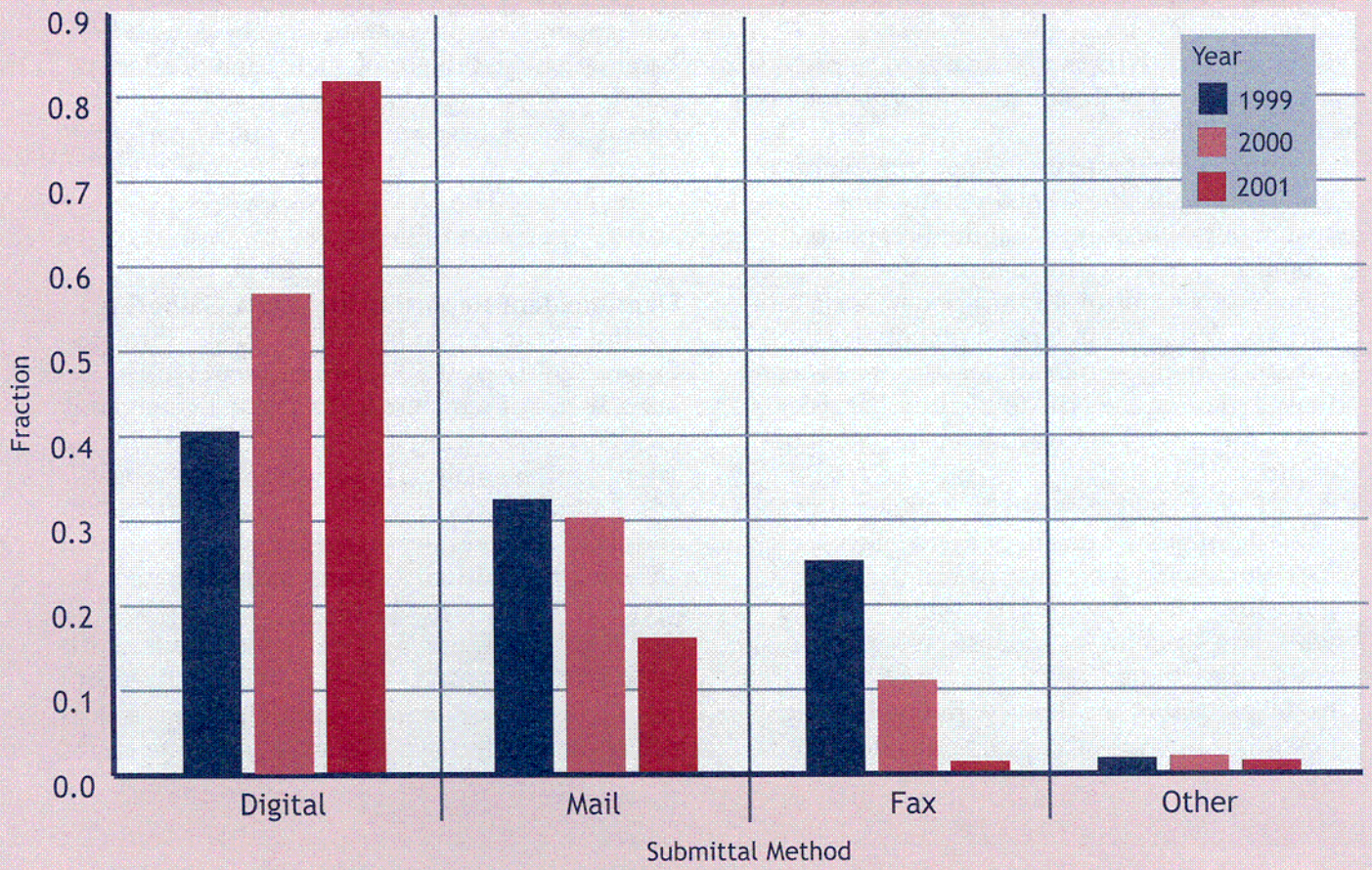
The past 2 years have seen a significant change in the way dam safety officials submit Dam Incident Notifications to the NPDP. In the past, the majority of the submittals have been through the mail or by fax. In the last 2 years, there has been a shift to electronic submittal of Dam Incident Notifications. These digital submittals are being made through e-mail and the NPDP web site. In addition to simply completing a Dam Incident Notification form, many states are sending digital documents as part of their submittals (*i.e.*, dam inspection reports and photographs). The movement toward digital reporting is illustrated in Figure 3, which shows that the fraction of digital notifications submitted to the NPDP has more than doubled since 1999.

Since the previous biennial report, there has been an increase in the number of Dam Incident Notifications submitted to the NPDP. While this is a positive sign, there are approximately 10-20 percent of the states reporting on a consistent basis, leading to speculation that the actual number of events that may occur is considerably greater.

Digital Library and Database

As part of a project supported by the National Dam Safety Program, the NPDP is developing a database and digital library system for dams (see Figure 4). The system is designed to provide dam safety professionals with access to informa-

FIGURE 3
SHIFT TO DIGITAL REPORTING OF DAM INCIDENTS



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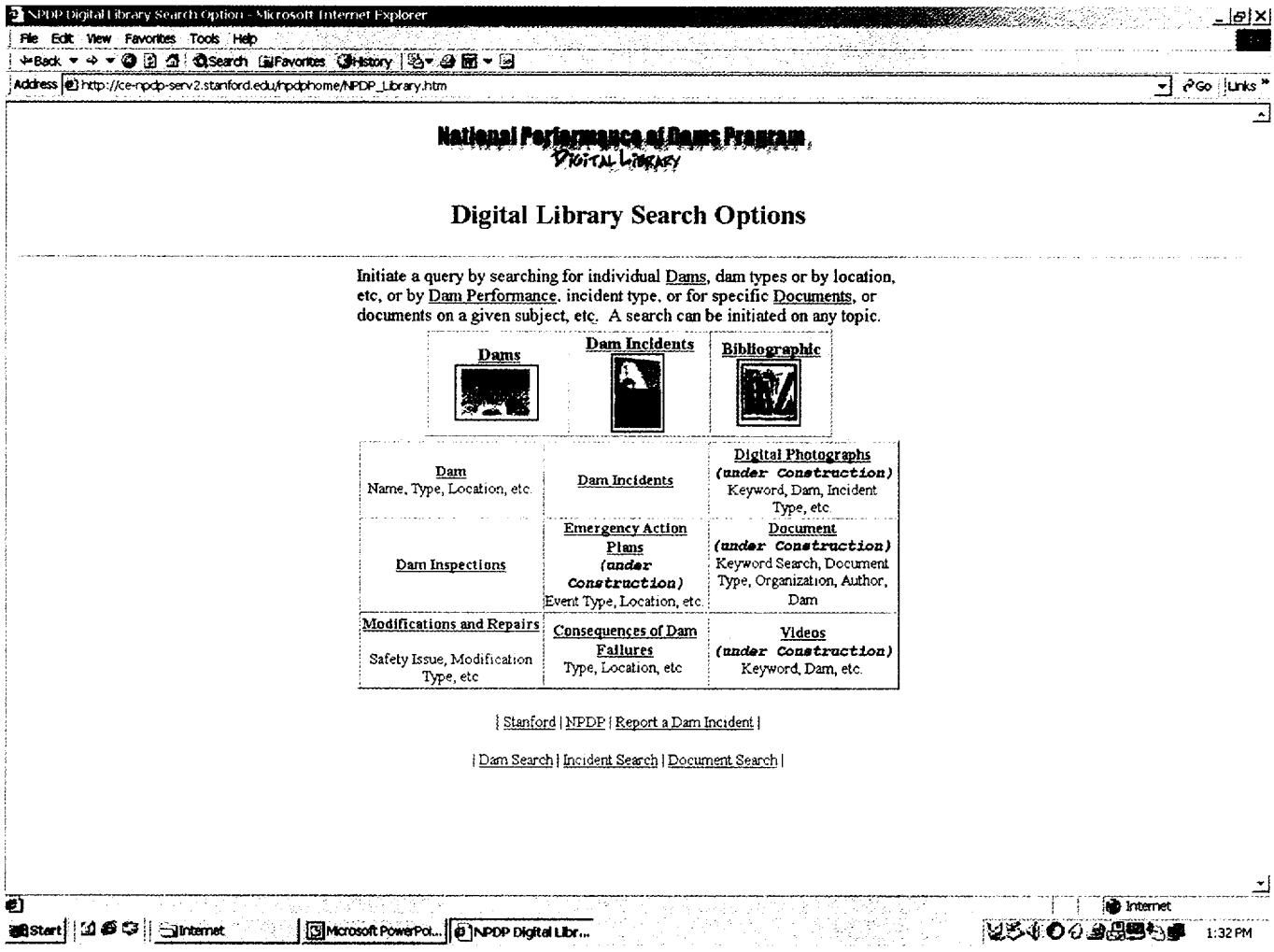
tion on dams, dam incidents, and dam safety modifications. The NPDP web site and digital library will provide users with Internet access to information and a variety of tools that includes:

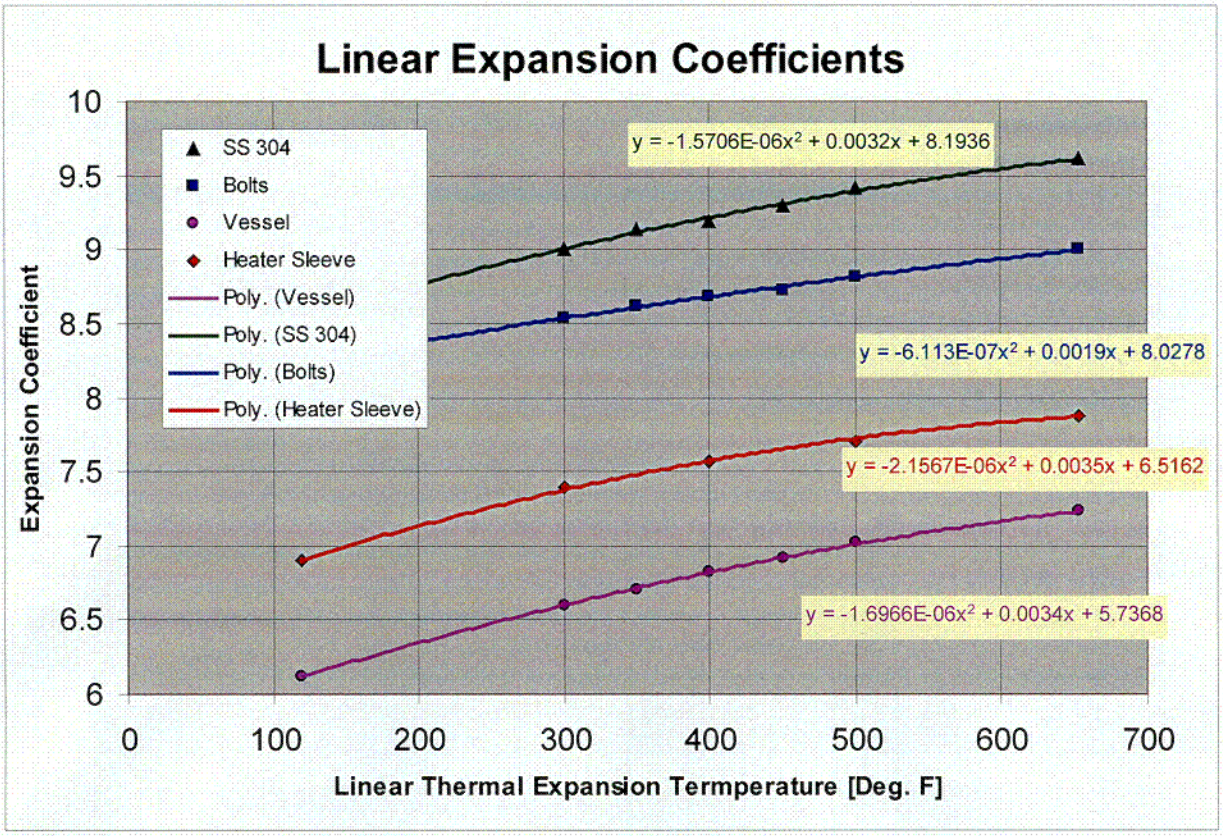
- NPDP databases that contain information on:
  - dam characteristics and location information (a dams directory)
  - dam incidents and failures
  - consequences of dam failures
  - dam repairs and modifications
- Photographs from dam inspections, dam incidents and failures (the NPDP currently has over 10,000 digital photographs in its archive)
- Dam inspection reports
- Online dam incident reporting capability, including the uploading of digital documents (*i.e.*, inspection reports, photographs)
- Real-time access to incidents and failures reported to the NPDP
- Online capability for users to generate reports (*i.e.*, graphs, spreadsheets and tables) on dam incident notification reports.

With the support of Program funding, the NPDP digital library system and user tools will provide the dam safety community and policy makers with ready access to a wide range of valuable dam safety information resources. The

FIGURE 4
NPDP DIGITAL LIBRARY WEB PAGE



Linear Expansion Coefficient used in the Thermal Growth Calculations for MNSA-2 Components



Expansion Coefficients

MNSA -2	Plant	Location	Spring Pack	Vessel	Compression Collar Inside Vessel	Compression Collar Outside Vessel	Hold Down Plates	Long Bolts	Short Bolts
Type 2	WFD	LL	7.48	7.23	9.61	9.50	9.12	8.67	8.70
Type 1	WFD	TWELL	7.48	7.23	9.61	9.53	9.12	8.71	8.71
Type 3	WFD	Inner HTR	7.48	7.23	9.61	9.41	9.12	8.58	8.71
Type 3	WFD	Outer HS	7.48	7.23	9.61	9.44	9.12	8.58	8.68

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tent data collection of DSPPM and NID information while maximizing flexibility for utilizing different inspection checklists.

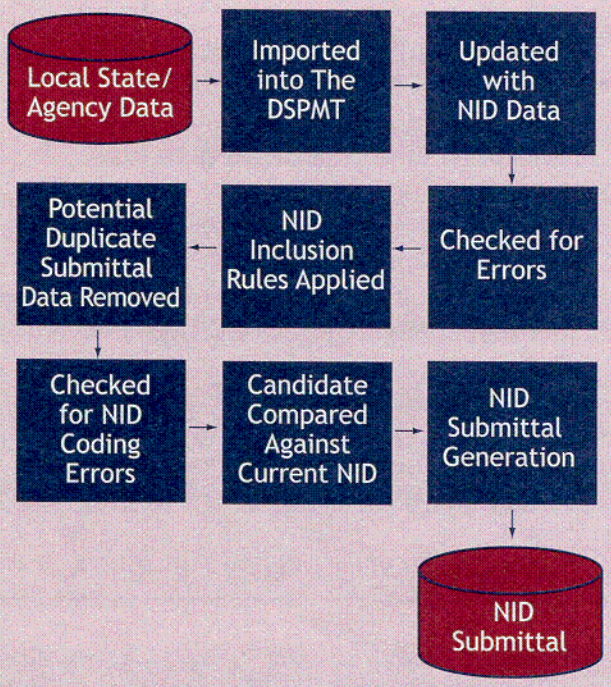
The National Inventory of Dams Electronic Submittal Workflow software is a natural extension of the NID and part of the DSPMT to help users provide a consistent, error-checked electronic submittal of inventory information. The NID Electronic Submittal workflow is shown in Figure 6.

Use of the DSPMT by federal agencies and the states is illustrated in the information flow overview shown in Figure 7. An organization's local inventory of dams, in a variety of data formats, can be imported into the DSPMT and used as the local inventory of dams for numerous functions, including performance measure data submittals, NID data submittals, generation of the FEMA State Evaluation Criteria Report, and the biennial report to the Congress on the National Dam Safety Program. The flexibility and utility of the DSPMT will facilitate the Dam Safety information flow, as shown in Figure 7.

By performing data submittal workflows at the state and agency level, those most familiar with the data and most qualified to make any changes, specifically the data owners, managers, and data providers, can achieve the one-time-only data entry objective while maintaining an up-to-date, error-checked, consistent format database of dam inventory and program performance information.

With continued reductions in budgets and staffing, both federal and non-federal dam safety programs are in need of continuous efficiency and effectiveness improvements. In addition, there is an ever-increasing need for performance-based reporting internally and to FEMA, Congress, and State Legislatures. The DSPMT provides the tools necessary for evaluating dam safety programs, for reporting accomplishments, and for expressing program needs to others. As a working tool, it implements true one-time-only data entry, provides assistance to program managers in achieving continuous program improvement, is a self-evaluation tool and an internal and external reporting tool, and encourages results-oriented management practices.

FIGURE 6
NID ELECTRONIC SUBMITTAL WORKFLOW



National Dam Safety Information Technology - A Time for Action

Since the implementation of the National Dam Safety Act of 1996, it has became increasingly evident that there are significant information gaps with respect to the ability of the dam safety community and the public to access information on the state of the Nation's dams and to evaluate progress with respect to the improvement of dam safety programs. Critical to effective management of the Nation's dams is the need for comprehensive and complete information resources that support day-to-day dam safety activities and the development of effective dam safety policies. To meet these information needs, FEMA created the National Dam Safety Information Technology Committee (NDSITC) in 2000 to develop a strategic plan for a national dam safety information technology system.

The strategic plan calls for the development of a virtual dam safety information technology network. The network will:

- Provide all basic data information needs for

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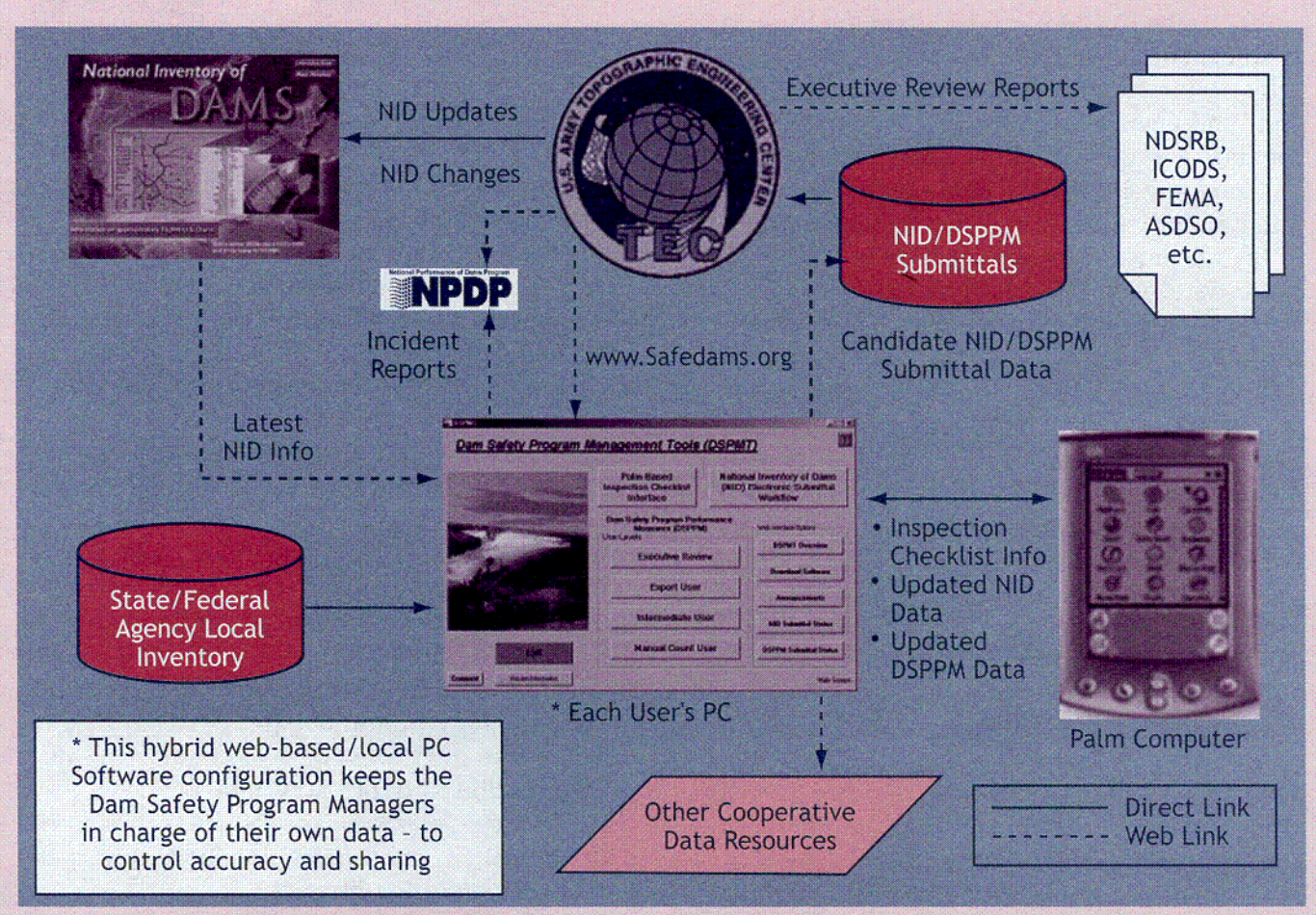
dam safety professionals that relate to the state of dams in the United States.

- Improve the efficiency and effectiveness of data collection, giving data providers the capability for seamless data submittal.
- Provide users with easy access and retrieval capabilities to a variety of distributed digital assets that support dam safety needs.
- Make available to users information on the changes in the condition of the Nation's dams that are identified as a result of routine analysis of data from dam inspections and incidents.
- Maintain an awareness of the needs of the dam safety community, updating data accessibility as information needs change.
- Offer the opportunity to capture the explosion of valuable information, which if retrieved in a timely and efficient manner, can support continued developments in dam engineering and safety.

The business of dam safety is a broad-based, public responsibility. This responsibility is fundamental – the prevention of events at dams that pose an unacceptable risk to public health, to property, and to the general well being of society as a whole. Meeting the public trust that accompanies this responsibility must be supported by a comprehensive and complete information base whose analysis provides insight to these risks and the condition and performance of this vital part of our built environment.

FIGURE 7
DSPMT INFORMATION FLOW OVERVIEW



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The October 4, 1979 Presidential memorandum that directed federal agencies responsible for dams to adopt and implement the *Federal Guidelines for Dam Safety* also directed the heads of these agencies to submit progress reports to the Director of FEMA. Since that initial report in 1980, the Director of FEMA has solicited follow-up progress reports from the agencies at 2-year intervals.

Highlights in FY 2000 and 2001

Over 20 years ago, the following statement was included in *Federal Guidelines for Dam Safety* (June 1979): "The Federal agencies have a good record and generally sound practices on dam safety." This statement continues to be true today. All of the federal agencies responsible for dams are implementing the provisions of the *Guidelines*, sharing resources whenever and wherever possible to achieve results in dam safety, and developing strategies to address diminishing resources and decreases in staffing levels. Each year also brings increased cooperation and coordination between the federal agencies and the states, resulting in a dam safety program that is truly national in scope.

There were two notable programmatic changes at the federal level during this reporting period. FY 1999 was the last year that the Tennessee Valley Authority (TVA) received appropriations from Congress. The legislation that eliminated the funding also transferred the Land Between the Lakes to the United States Department of Agriculture (USDA). As a result, five low-hazard potential dams were transferred to the U.S. Forest Service (FS).

In a major change in agency authority from the last report, the Natural Resources and Conservation Service (NRCS) is now authorized to provide project sponsors with technical and financial assistance to rehabilitate their aging project dams. This new authority was provided by the Small Watershed Rehabilitation Amendments of 2000 (Public Law 106-472). The amendments will enable NRCS to work with existing project dam owners at their request to implement dam safety improvements or decommission and remove their dams. The law authorizes $90 million total funding over 5 years and limits federal funds to 65 percent of the total cost of any rehabilitation project. The NRCS has estimated that more than $600 million is needed to rehabilitate existing project dams to a safe and functional condition.

Federal Agency Accomplishments

Below is a description of federal agency activities during FY 2000-2001 in some of the areas covered by the *Guidelines*.

Organization, Administration, and Staffing

As in previous reporting periods, reductions in funds and the corresponding decrease in staffing levels for dam safety remain a concern. According to the United States Army Corps of Engineers (Corps) report, there are serious challenges facing its dam safety organization and the dam safety community in the United States. In FY 2000-2001, a number of Corps Districts lost experienced engineers and engineering technicians from their Dam Safety offices to retirement. Projected retirements during the next 5 years will affect dam safety staffing in several locations. To address this challenge, the Corps has implemented a number of initiatives, including a proactive dam safety program of extensive training and research and development.

NRCS dam engineering expertise and staffing levels also have declined in most parts of the United States as the federal dam design and construction activity has decreased (Figure 8). NRCS installed more than 1,200 new Inventory dams in 1965 but less than 100 in 1990 and probably less than 30 in 2000. The number of NRCS engineers and engineering technicians has declined significantly over the past decade, and current NRCS staff is not sufficient to provide highly qualified technical assistance for dams in every state. To address declining expertise, the NRCS organized a new technical service center in 2000. The National Design and Construction Center, located in Fort Worth, Texas, will provide expert advice to other NRCS offices in the areas of design, construction, geology, and soil mechanics. This new

staff currently consists of approximately 20 experienced professionals from the NRCS, the Bureau of Reclamation (BOR), and the Corps offices. The Center was fully functional at the end of 2000.

The BOR reports that it has excellent management and technical staff resources to accomplish its dam safety activities in accordance with the *Guidelines*. However, the maintenance of technical expertise is now receiving the attention of BOR's leadership. BOR has implemented a workforce capability planning process that uses a strategic planning approach to match staff resources with future program needs.

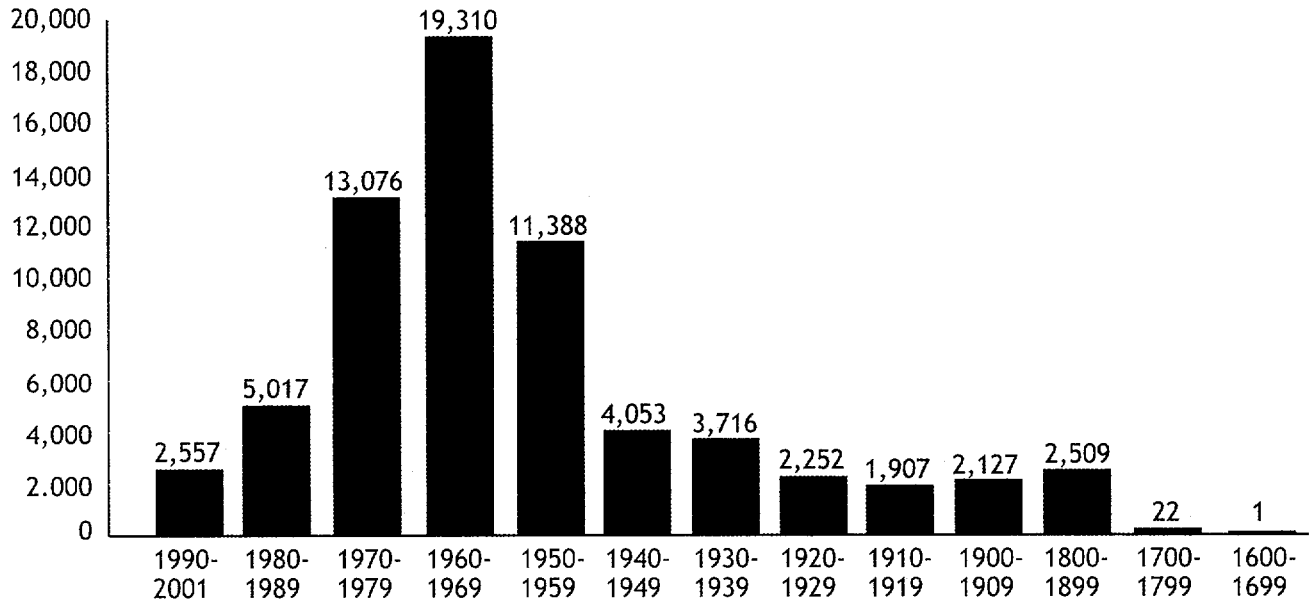
The Bureau of Land Management (BLM) reports a 39 percent increase in dam safety program activities in the FY 2000-2001 period compared to FY 1998-1999. The increase is a testament to the BLM's commitment to its dam safety program. The BLM completed its National Management Strategy for Dam Safety in June 2001. The strategic plan includes all factors necessary to maintain an effective dam safety program.

Inspection Programs

In FY 2000-2001, inspections of Nuclear Regulatory Commission (NRC) dams were conducted by the Federal Energy Regulatory Commission (FERC) with NRC personnel under a technical assistance agreement between NRC and FERC. FERC personnel, accompanied by NRC staff, completed inspections at 10 licensee facilities, 3 of which are associated with the extraction of uranium and 7 of which are nuclear safety-related dams at nuclear-powered electric generating facilities. Inspections of Department of Energy (DOE) dams also are conducted by FERC.

During the reporting period, the Mine Safety and Health Administration (MSHA) completed a nationwide inspection of all regulated coal mining-related impoundments and all impoundments determined to be of high-hazard potential classification. In FY 2000 and 2001, MSHA engineers and impoundment specialists conducted a total of 1,272 inspections of metal and nonmetal mine impoundment and tailings structures.

FIGURE 8
AGE OF DAMS IN THE U.S.



Source: NID, U.S. Army Corps of Engineers, January 2001

Dam Safety Training Activities
Training continues to be a strong component of most of the federal programs in dam safety. The main thrust of TVA's training continues to be on-the-job training under the supervision of experienced engineers and inspectors. TVA has classroom and hands-on instruction for operating, maintenance, and inspection personnel. Technically qualified TVA project personnel are trained in inspection procedures, problem detection, evaluation, and appropriate remedial (emergency and non-emergency) measures.

During the reporting period, MSHA provided a significant amount of dam safety related-training to its review engineers and by its review engineers and others to district impoundment specialists. The training included the 2000 Impoundment Seminar and the 2001 Impoundment Seminar, both held at the National Mine Health and Safety Academy in Beckley, West Virginia.

The Corps has an extensive program for training personnel in all matters related to its missions in water resources development; much of the training is directly or indirectly related to dam safety. The program, which provides training for engineers and dam operation and maintenance personnel, consists of seminars and conferences, formal classroom training, and periodic on-site training. Practical on-the-job-training is continually provided using formal exercises simulating dam safety emergencies. Alert notification tests, which are conducted at the project level, involve various levels of the Corps organization as well as other federal, state, and local officials.

The DOI held annual DOI Dam Safety Coordinators Meetings in June 2000 and May 2001. Representatives from the DOI Bureaus, various Tribes, the Corps, NRCS, the FS, and the Association of State Dam Safety Officials (ASDSO) attended both meetings. BOR continued to participate in a cooperative effort with DOI, ASDSO, the Louisiana Department of Transportation, and Southern University at Baton Rouge, Louisiana to provide a Dam Safety Training Program as part of the University's curriculum. BOR also sponsored a weeklong seminar on the Safety Evaluation of Existing Dams (SEED) in April 2000 and 2001. Although the seminar is based on BOR's SEED program, many other state and federal agencies participate in the seminar.

Historically, the U.S. Fish and Wildlife Service (FWS) has provided training to refuge and hatchery staffs, dam tenders, and regional dam safety representatives. As a result of a recent DOI Peer Review recommendation, the FWS has initiated a servicewide dam safety training program. The objective is to provide dam safety training to all field stations where high- and significant-hazard potential dams are located. In FY 2000, the FWS presented the course at over one-half of the field stations. In FY 2001, the FWS will present the course at the remaining field stations.

Emergency Action Planning
The FERC training program is highly acclaimed and both nationally and internationally recognized. The National Dam Safety Program has identified FERC as the national expert on emergency action planning and has proposed that FERC take the lead in guiding a national program on emergency action planning and implementation. The FERC EAP program was the first to be fully developed for dam owners, and 99.9 percent of FERC jurisdictional dams requiring an Emergency Action Plan (EAP) have one, compared to a national average of only 30 percent.

Although there are practical considerations that limit the feasibility of conducting full-scale exercises of an EAP, FERC is requiring its licensees to conduct functional exercises that involve emergency preparedness agencies in EAP testing. The functional exercise, which is preceded by orientation seminars, annual drills, and a tabletop exercise, includes representatives from licensees and all involved agencies to test the EAP under stressful, timed conditions. The exercise evaluates the effectiveness of the notification plan, inundation maps, and actions that local agencies take after they receive notification that an emergency is occurring at a dam.

Recently, FERC made special efforts to increase the spirit of cooperation and coordination between dam owners and the local response agencies associated with their EAP's. As a result, rep-

resentatives from state dam safety offices, local and state emergency response agencies, floodplain managers, the National Emergency Management Agency (NEMA), FEMA, and the National Weather Service (NWS) have been invited to FERC training courses. The exchange of information among these agencies and licensees has resulted in an improved understanding of the needs of each participant, and will greatly improve the likelihood of saving lives if an emergency should occur. FERC also has recently initiated efforts to encourage licensees to develop EAP efforts that include active participation by upstream and downstream owners. This widened approach for coordination will optimize the time and effort required by the local response agencies, and will encourage many non-FERC regulated dam owners to participate in an EAP exercise for the first time and provide opportunities for state dam safety officials to participate and test dams under state jurisdiction. The latest EAP initiative undertaken by FERC is the creation of an international EAP workshop, which is being co-sponsored with ASDSO.

The U.S. Section of the International Boundary and Water Commission (IBWC) has an EAP in place for each of its two large storage dams (Amistad and Falcon) and the Anzalduas Diversion Dam. In FY 2000-2001, the IBWC held annual Flood Emergency Workshops with the participation of the U.S. and Mexican Sections and the NWS. In 2001, a series of four International Sister Cities Exchange Workshops were held at Amistad Dam, Falcon Dam, Mercedes Texas, and Nuevo Laredo. The workshops were attended by a wide spectrum of civil and political authorities from the United States and Mexico. The U.S. Section also is negotiating a contract to obtain better field information from the United States and the Mexico sides of the Rio Grande to refine inundation maps contained in the U.S. Section's EAP's. The refined inundation maps will provide a basis for conducting tabletop exercises with law enforcement officials from both countries.

Baker Dam, Washington

TVA conducted three functional level exercises during the reporting period, including one cooperative exercise with the Corps. TVA personnel participating in the drills and exercises included engineers, police, reservoir system forecasters, hydro operations and maintenance staff, land specialists, and media relations and communications staff. Area representatives from local and state emergency management agencies also participated at the invitation of TVA.

The National Park Service (NPS) cooperates with other dam owners whose structures affect the National Park System by preparing and annually updating early warning, search/rescue, and evacuation plans for affected NPS areas in the event of large releases from, or the failure of, a non-NPS dam. The NPS has informal agreements with some local owners and communities to ensure the safety of the public and the protection of the resource.

Research and Development and Special Initiatives

Today's challenge of aging dams, limited resources, and the future increased reliance on the services that dams provide are among the most complex faced by the dam safety profession. A special initiative of the FERC dam safety program during this reporting period was the development of a new performance monitoring system. About 70 percent of the approximately 2,600 dams under FERC regulation are over 50-years-old. In light of the aging of FERC dams and construction and design standards that were not in existence when the dams were built, FERC is developing a program to properly monitor dams so that they remain in safe operating condition. FERC believes that a comprehensive and efficient performance monitoring program should start by examining the ways in which a structure can fail and then only monitor those parameters that could contribute to the failure modes. As a result, FERC is proposing to include failure mode and consequences analyses as a feature in its performance monitoring program to focus and thereby limit the performance parameters that will be monitored. This will be done site specifically and will help to better define the important areas of a structure and its foundation that need to be inspected and evaluated.

Two Corps research studies focus directly on dam safety: the Risk Analysis for Dam Safety Research Program and the Earthquake Engineering Research Program. The objective of the Risk Analysis for Dam Safety Research Program is to develop and implement risk analysis methods to (1) prioritize dams requiring initial investigations and subsequent analyses; (2) prioritize funding for crucial repairs, rehabilitation, or modifications; (3) select and justify the optimal plan to project human life, reduce property damage, and mitigate environmental damage; (4) minimize the disruptions of services; and (5) maximize the effectiveness of infrastructure investments. The objective of the Earthquake Engineering Research Program is to reduce damage from a potential devastating earthquake by advancing state-of-the-art knowledge of earthquake hazard assessment, seismic design, and remediation of Corps dams and other infrastructure. Results of Corps research and development efforts are directly incorporated into practice within the Civil Works Program through the Civil Works Guidance Maintenance Program. The Corps also has the lead in the coordination of the National Inventory of Dams (NID) and in coordinating the development of the Dam Safety Program Management Tools software, both of which are described above.

At part of the site closure plan at Rocky Flats, DOE is considering some long-term stewardship options for the dams. One option is to convert the detention ponds to wetlands for sediment stabilization and wildlife habitat and to modify the dams to permit a natural flow-through of water. A second option is an upgrade of the dams to BOR standards and transfer of long-term stewardship of the dams to the FWS as part of a proposal to convert the site to a wildlife refuge.

The NRCS and the Agricultural Research Service (ARS) have monitored earth spillway performance during flood flows since 1983 and continue to build a database of performance based on spillway geometry, flood flow, and soil and rock parameters. ARS also has conducted extensive laboratory and field research at its research

facility in Stillwater, Oklahoma to define erosion thresholds and headcut advancement processes. This work culminated in a mathematical model to predict initial failure of spillway vegetation, initial gully formation, and progressive advancement of the headcut through the spillway. The earth spillway erosion model has been incorporated into existing NRCS dam design software, which has been renamed SITES. The software, which was released in test form in April 1997, is now being used by NRCS and others.

BOR continues to emphasize the use of risk analysis in its evaluation processes. Collaboration with the Canadian Electric Association, especially British Columbia Hydro, and Australian interests continues as BOR further develops and refines risk analysis approaches. BOR continues to develop and refine a guideline entitled *Dam Safety Risk Analysis Methodology*, a working document on risk analysis methods and a series of technical guides that define procedures for estimating risk.

The FWS has used BOR's Risk Based Profiling System to evaluate all of its high- and significant-hazard potential dams, and will use the System to evaluate the failure index of all of its inventoried low-hazard potential dams. The FWS plans to evaluate the System and other risk analysis tools and to continue to incorporate risk analysis in the dam safety evaluation and decision-making process.

A program that was initiated by TVA involved the "hands-on" inspection of spillway gates. Inspectors have been certified in repelling or "rope access" and perform detailed inspections. These inspections have resulted in the identification of some deficiencies that would not have been identified previously, such as cracked welds, bent members, clogged drain holes, and broken grease lines.

State Dam Safety Agency Involvement

NRCS policy is to support and complement strong state dam safety programs, and to establish working arrangements in each state. NRCS Headquarters and ASDSO have a Memorandum of Understanding (MOU) to regularly exchange information on dam safety activities, provide data to the National Performance of Dams Program, maintain data in the NID, and share research and technology. The MOU further encourages each NRCS State office to develop individual memoranda with their state agencies.

The FS encourages involvement with the states in all aspects of dam safety and the FS regions have MOU's with most states. The FS encourages the states to assume jurisdiction for permitted dams and to become involved in the management of FS-owned dams.

BOR continues to maintain strong working relationships with state dam safety agencies. BOR has MOU's with each of the 17 Western states where it has facilities. Annual meetings between BOR and the states are conducted and state representatives participate with BOR staff on dam safety inspections. The states also participate with BOR on specific issues associated with individual structures, such as modifications, reservoir restrictions, and environmental concerns.

During all formal NPS and BOR evaluations, the states are invited to participate. State dam safety and environmental program representatives provide helpful suggestions in managing NPS dams and monitoring non-NPS dams. Those states that have been particularly active with the NPS Dams Program are Massachusetts, Pennsylvania, New York, New Jersey, Virginia, North Carolina, Florida, Ohio, Wyoming, Washington, Tennessee, and Colorado.

Public Concerns

The public has voiced concerns over safety below TVA dams and has requested that TVA do more to inform them of potential dangers. As a result, spillway warning signs with strobe lights are being installed at all main river and selected tributary dams; turbine warning systems with audible alarms and strobe lights are being installed at all main river and selected tributary dams; and signage will be upgraded at all dams. A campaign to raise public awareness of water safety will include distributing brochures and conducting safe boating/recreational training sessions at schools throughout the Valley.

Applegate Dam, Oregon

FOCUS ON THE FUTURE

This progress report for FY 2000 and 2001 presents the first opportunity to assess and document progress made since the passage of the National Dam Safety Program Act. From the reports submitted by the states and federal agencies, it is clear that the Act is resulting in significant improvements in the Nation's dam safety: the states have increased the number of emergency action plans for state-regulated high- and significant-hazard potential dams and the number of dam inspections; almost all of the states have success stories to tell as a result of Program funding; the research program is advancing the state-of-the-practice and producing both expert level and laymen documentation; the training program is allowing the states to focus their training on their specific needs; and the federal agencies continue to operate and maintain strong dam safety programs.

Notwithstanding the achievements, more can be accomplished in the National Dam Safety Program to address both long-standing issues and recent events. As was discussed in the last biennial report, the Nation's infrastructure of dams is aging. The 2001 Report Card from the American Society of Civil Engineers states that there are more than 2,100 unsafe dams in the United States. The 2001 Report Card also states that the number of high-hazard potential dams has increased since 1998 from 9,281 to 9,921 (data provided by ASDSO). These statistics focus on the crux of one of the most important issues: the aging of the Nation's water infrastructure and how we will cope with the problem in an era of diminishing resources. The dam safety community is working on a number of options to address the issue, including model loan programs for the repair of dams, dam removal projects, and rehabilitation programs.

Other long-standing issues relate to the identification and classification of dams, including the number of unregulated dams that have not been reported to the National Inventory of Dams; the number of dams that have not been classified correctly; and whether the classification of a dam has changed over time, particularly in light of increases in downstream populations. Moreover, hazard classification alone does not give a clear picture of the risk of failure as the classification is independent of the condition of the dam and represents only the potential consequence of failure relative to loss of life and property damage downstream. A number of federal agencies are increasing their focus on the development of risk analysis methods and the best ways in which to incorporate risk analysis into evaluation and decision-making processes.

Dam removal is another issue that has come to the forefront over the last 2 years. Dam removal has become an accepted and functional tool in dam safety programs across the country, with over 500 dams nationwide removed, many due to dam safety risks. In some circumstances, the removal of obsolete and unsafe dams can be a more cost effective option than repair or replacement, which can thus produce benefits for both the local community and national dam safety interests.

Meeting information resource needs in dam safety also is a challenge. There are now a number of organizations and projects involved in gathering and maintaining information resources related to dams, dam performance, and dam safety programs. These organizations and projects have done excellent work in providing their users with timely, accurate, and specific data. It is clear, however, that a comprehensive information resource system is now needed. To that end, the National Dam Safety Program is developing a strategic plan to establish a national dam information resource system that will bring together a great amount of information with the goal of improving dam safety nationally. The development of a national dam information resource system is particularly important as the system can be used for future developments and improvements in dam safety, with the ultimate goal of benefiting society and, in particular, protecting the public.

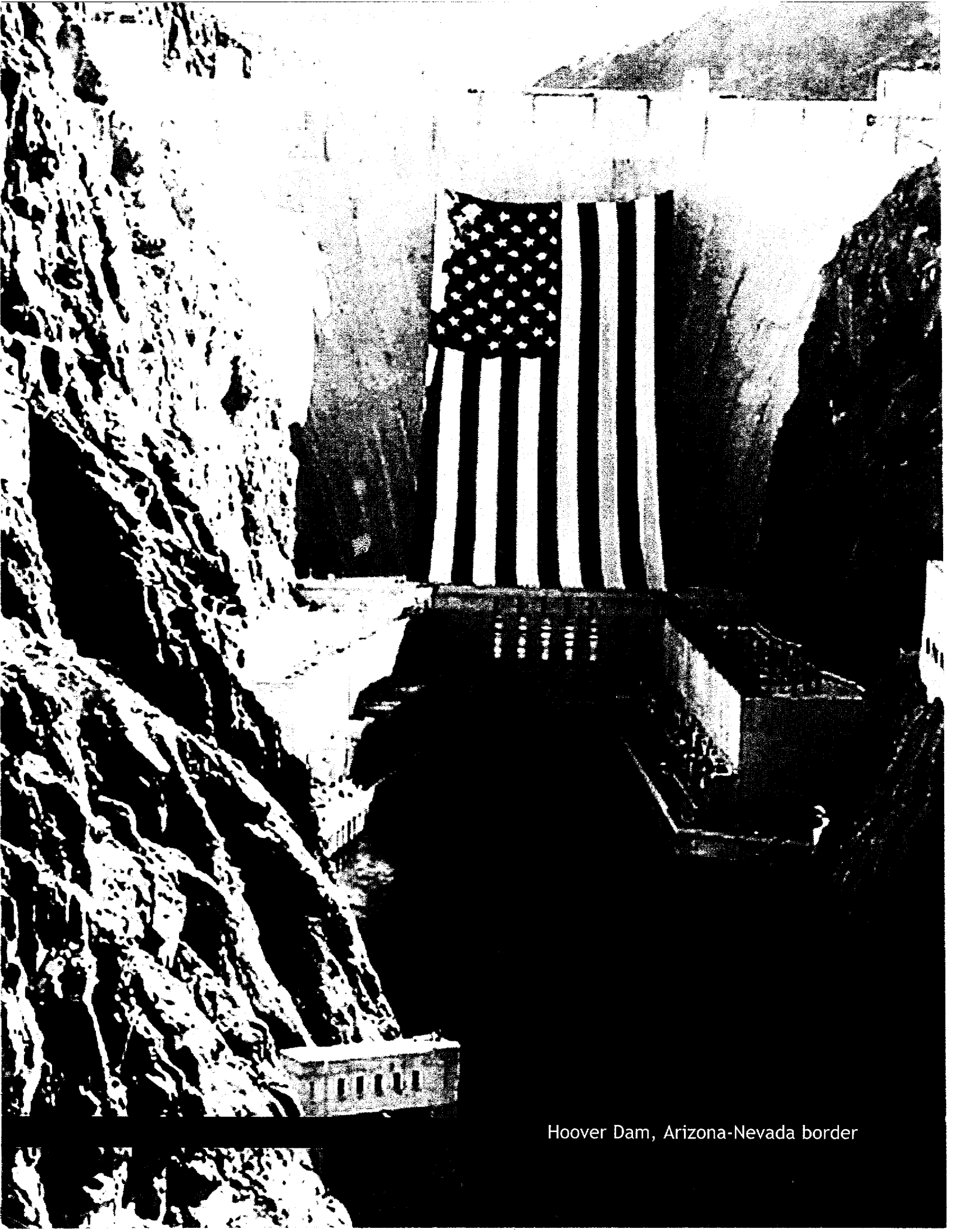
The recent accomplishments in dam safety will continue over the next 2 years, with an increased focus on the sharing of resources through collaborative efforts. As in previous reporting periods, the decrease in dam design and construction ac-

tivity and the corresponding decrease in staffing levels and resources for dam safety remain a concern. According to the states and a number of federal agencies, these are serious challenges facing dam safety organizations and the dam safety community in the United States. To address these challenges, many organizations are implementing a number of initiatives, such as training and coordination projects, to maintain a viable and well-qualified workforce to address dam safety matters.

The terrorist attacks at the close of the last fiscal year have brought an increased focus on infrastructure protection nationwide, including the safety of dams. Addressing this most important issue and others will be a priority of the national dam safety agenda in the next 2 years, as will sustaining the progress already made by all of the partners in dam safety. With the legislative authorization of Public Law 104-303 and the support and commitment of FEMA, the National Dam Safety Program will continue to provide the leadership and coordination needed to ensure the safety of all those who live, work, or play downstream of dams, or receive benefits from dams.

LIST OF ACRONYMS

ARS	Agricultural Research Service
ASCE	American Society of Civil Engineers
ASDSO	Association of State Dam Safety Officials
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
DOE	Department of Energy
DOI	Department of the Interior
DSPMT	Dam Safety Program Management Tools
DSPPM	Dam Safety Program Performance Measures
EAP	Emergency Action Plan
EMI	Emergency Management Institute
EPRI	Electric Power Research Institute
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FS	United States Forest Service
FTE	Full-Time Equivalent
FWS	United States Fish and Wildlife Service
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
IBWC	International Boundary and Water Commission
ICODS	Interagency Committee on Dam Safety
ICOLD	International Commission on Large Dams
MSHA	Mine Safety and Health Administration
NDSITC	National Dam Safety Information Technology Committee
NEMA	National Emergency Management Agency
NETC	National Emergency Training Center
NID	National Inventory of Dams
NPDP	National Performance of Dams Program
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OSM	Office of Surface Mining
SEED	Safety Evaluation of Existing Dams
TADS	Training Aids for Dam Safety
TVA	Tennessee Valley Authority
USDA	United States Department of Agriculture
USSD	United States Society on Dams



Hoover Dam, Arizona-Nevada border