



Dam Safety and Security in the United States

A Progress Report on the National Dam Safety Program

Fiscal Years 2004 and 2005

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FEMA

Cover Photo Courtesy of:
DeGray Dam, Arkadelphia, AK
U.S. Army Corps of Engineers

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J. Strom Thurmond Dam, SC. Photo courtesy U.S. Army Corps of Engineers.

Executive Summary

In July 1979, the Federal Emergency Management Agency (FEMA) was established by Executive Order 12148 in response to the need for unified and coordinated efforts for federal assistance in national disasters. Executive Order 12148 also provided that the Director of FEMA would coordinate all federal efforts in dam safety. In 1986, Title XII of the Water Resources Development Act was enacted to establish and maintain dam safety programs, including training for state dam safety inspectors. Ten years later, in 1996, the Water Resources and Development Act of 1996 (Public Law 104-303) codified a program that had been successfully promoting dam safety and mitigating the effects of dam failures for almost 20 years. Section 215 of Public Law 104-303 formally established the National Dam Safety Program and named the Director of FEMA as its coordinator. The passage of the 1996 Act represented the culmination of years of collaborative effort on the part of many in the dam safety community to statutorily create the National Dam Safety Program.

The Dam Safety and Security Act of 2002 (Public Law 107-310), signed into law on December 2, 2002, reauthorized the National Dam Safety Program for 4 more years and added enhancements to the 1996 Act that are designed to safeguard dams against terrorist attacks. The Act of 2002 continued all of the programs established by the 1996 Act that have been serving to increase the safety of the Nation's dams. These programs include grant assistance to the states, which provides vital support for the improvement of the state dam safety programs that regulate over 79,500 dams in the United States; training for state dam safety staff and inspectors; and a program of technical and archival research, including the development of devices for the continued monitoring of the safety of dams. The Act of 2002 also provides that the Director of FEMA will submit a biennial report to the Congress that describes the status of the National Dam Safety Program, the progress achieved by the federal agencies during the 2 preceding fiscal years in implementing the *Federal Guidelines for Dam Safety*, and the progress achieved by the states participating in the National Dam Safety Program. Highlights of the progress described in this biennial report are summarized below.

State Programs Continue to Show Improvement

The primary purpose of the Dam Safety and Security Act of 2002 is to provide financial assistance to the states for strengthening their dam safety programs. In Fiscal Year (FY) 2004 and 2005, FEMA distributed approximately \$6.5 million to all of the participating states and Puerto Rico for dam safety.

There continue to be improvements in the Nation's dam safety as a result of the state assistance funding. In 1998, the National Dam Safety Review Board (Review Board) 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.

2 A comparison of data from the states for 2002 and 2004 indicates that National Dam Safety Program funding has continued to contribute to increases in the number of EAP's over the past 2 years. Today, 39 percent of all state-regulated high- and significant-hazard potential dams have an EAP. Since 1998, the number of EAP's for state-regulated high- and significant-hazard potential dams has increased from 3,600 dams to approximately 7,000 dams in 2004. Of particular note are increases in EAP's for high-and significant-hazard potential dams reported by the States of Alaska, Kansas, Nevada, New Jersey, Utah, Vermont, and Washington, and the U.S. territory of Puerto Rico.

The number of dam inspections conducted by the states also has increased since data was first collected for 1998-1999, from a total of approximately 13,000 inspections to approximately 15,000 inspections in 2004. This data is particularly impressive given the reported decreases in state dam safety budgets, and emphasizes the importance of the National Dam Safety Program in supporting state dam safety programs. According to the most recent information submitted by the states to the Association of State Dam Safety Officials (ASDSO), state dam safety budgets have decreased by 12 percent over the past 2 years, from a total of approximately \$33 million in 2003 to approximately \$29 million in 2004. The numbers for 2005 are not yet available.

Delaware Establishes Dam Safety Program

In July 2004, the Delaware Governor signed House Bill 514, which establishes a dam safety program in the Delaware Department of Natural Resources and Environmental Control. The legislation, which was unanimously passed by the Senate in June 2004, authorizes the Department to adopt standards for maintenance and operation of publicly owned dams and to conduct dam inspections. At the end of the last reporting period, Delaware was one of only two states that did not have dam safety regulatory legislation. The other state, Alabama, is now working on legislation.

Research Products Enter Pipeline

To guide decisions on the funding of specific research projects, the Review Board developed a 5-year Strategic Plan to prioritize research needs in dam safety and security. The goal in developing the 5-year Strategic Plan was to ensure that priority would be given to those projects that demonstrate a high degree of collaboration and expertise, and the likelihood of producing products that will contribute to the safety and security of dams in the United States. The Department of Homeland Security (DHS) is currently working to harmonize the Review Board's 5-year Strategic Plan for research and development with the dam security research plan developed for the Dam Sector Annex to the National Infrastructure Protection Plan (NIPP).

In April 1999, the first full year of National Dam Safety Program funding, the Interagency Committee on Dam Safety (ICODS) Research Subcommittee, now the Review Board Dam Safety Research Work Group, identified 17 broad area topics related to the research needs of the dam safety community. Over the past 6 years, research funds were allocated to workshops in nine of the priority areas. Based on the results from the workshops, research topics were proposed and pursued. Several topics have now progressed to products of use to the dam safety community, including technical manuals and guidelines.

Performance Measures Established

In FY 2004, the Review Board established the Task Group on Performance Measures to develop performance measures for the National Dam Safety Program and to update the Strategic Plan for the National Dam Safety Program. In FY 2005, the Task Group met numerous times to develop and refine both state and programmatic performance measures. The resulting performance measures lay the groundwork for both short- and long-term goals for the National Dam Safety Program over the next 5 to 10 years. The performance measures are discussed in the last section of this biennial report, *Focus on the Future*.

The Dam Safety Program Management Tools (DSPMT) program, which has received major emphasis and funding under the National Dam Safety Program, continues to collect very valuable data on the status of dams and dam safety programs in the United States. This software program, which is operated and maintained by the U.S. Army Corps of Engineers (Corps), is generating data for the evaluation of the “health and progress” of dam safety programs on a national scale. The DSPMT will be an important tool in the collection of data for the performance measures during the next reporting cycle.

Training Program Successes Continue

Since the inception of the National Dam Safety Program in 1979, FEMA has supported a strong, collaborative training program for dam safety professionals and dam owners. With the training funds provided under Public Law 104-303 and Public Law 107-310, 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 in 2004 and 2005 included National Dam Safety Program Technical Workshops on hydrologic deficiencies and potential failure mode analysis and monitoring; the ASDSO Regional Technical Seminars; state training assistance funds; hydrologic modeling system and river analysis system workshops at FEMA’s Emergency Management Institute; and the Training Aids for Dam Safety (TADS) Program. The Corps has begun scanning TADS modules and the ICODS Dam Safety Video Series for placement on the Corps Learning Network website at <http://usaceln.org/technical>. This effort, which will give these products the broadest distribution, will be completed by the end of FY 2006.



Aerial view of Kortes Dam and Reservoir, 60 miles SW of Casper, WY, on the North Platte River. Photo courtesy U.S. Department of the Interior, Bureau of Reclamation.

Federal Agencies Maintain Strong 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* (June 1979), the federal agencies have done an exemplary job in ensuring the safety of dams within their jurisdiction.

For FY 2004 and 2005, all of the federal agencies responsible for dams implemented the provisions of the *Federal Guidelines*. They accomplished this by sharing resources whenever and wherever possible to achieve results and improvements in dam safety. Many of the federal agencies also continue to maintain very comprehensive research and development programs and training programs, and have now incorporated security considerations and requirements into these programs to protect their dams against terrorist threats.

This progress report for FY 2004 and 2005 presents the opportunity to assess and document progress made since the passage of the National Dam Safety Program Act and to plan for the future. From the reports submitted by the states and federal agencies, it is clear that the National Dam Safety Program is contributing to significant improvements in the Nation's dam safety. By building on these and other accomplishments, FEMA and its partners in the National Dam Safety Program will continue to keep our dams safe and secure.



Carters Dam, GA. Photo courtesy U.S. Army Corps of Engineers.

The Federal and State Role in Dam Safety

In the 20th Century, the rapid growth of the American economy and population caused a corresponding increase in the demand for water infrastructure projects. Legislation such as the Reclamation Act of 1902, the Tennessee Valley Authority (TVA) Act of 1933, and the Flood Control Acts of 1936 and 1938 resulted in large numbers of government built new dams. Many of the new dams were larger in size because of advances in construction and materials, particularly in earth-moving equipment. Dam building in the United States peaked during the 30 years following World War II, when over one-half the Nation's current total of approximately 79,500 conventional type dams were built.

Today, dams are a vital part of the Nation's infrastructure. Dams provide a range of economic, environmental, and social benefits, including hydroelectric power, river navigation, water supply, wildlife habitat, waste management, flood control, and recreation. The term "dam" includes conventional dams, navigation locks, levees, canals (excluding channels), or other similar types of water retention structures. The majority of locks and levees in the United States are operated and maintained by the U.S. Army Corps of Engineers (Corps).

Although most locks are included in the National Inventory of Dams (NID), the NID does not include levees.

Some examples of the benefits of dams and locks are shown below.

- **Irrigation:** About 8 percent of American cropland is irrigated using water stored behind dams, and thousands of jobs are tied to producing crops grown with irrigated water. In a typical year, the Department of the Interior (DOI) Bureau of Reclamation (DOI Reclamation) projects in the Lower Colorado Region supply irrigation water to more than 2.7 million acres of lands in the United States and Mexico.
- **Electrical generation:** The United States is one of the largest producers of hydropower in the world, second only to Canada. Dams produce over 103,800 megawatts of renewable electricity and meet 8 to 12 percent of the Nation's power needs, or enough electricity to supply the nearly 35 million residential customers in California, New York, Ohio, Pennsylvania, and Texas.

- **Renewable, clean energy:** As a renewable source of electricity, hydropower is considered clean because it does not contribute to global warming, air pollution, acid rain, or ozone depletion. In 1999, hydropower avoided the release of an additional 77 million metric tons of carbon equivalent into the atmosphere. Without hydropower, the United States would have to burn an additional 121 million tons of coal, plus 27 million barrels of oil, and 741 billion cubic feet of natural gas combined.
 - **“Black Start” capabilities:** There are 4,316 megawatts of “incremental” hydropower available at sites with existing hydroelectric facilities. “Incremental” hydropower is defined as capacity additions or improved efficiency at existing hydro projects. During the August 2003 blackout in the Northeast, hydropower projects in upstate New York and several other states continued to run, leading the way to restoring power to millions of Americans. During the blackout, affecting an estimated 50 million people from New York City to Michigan, hydropower facilities were the first to be put into service to initiate grid stability and restore power. Hydropower’s unique operational characteristics allow it to generate power almost immediately, while other sources can take hours to days to come back into service.
 - **Water storage:** Dams create reservoirs throughout the United States that supply water for a multitude of uses, including industrial, municipal, and agricultural. Each year, the Corps reservoirs supply water to approximately 10 million people in 115 cities. DOI Reclamation, in a typical year, supplies more than 18 million people with municipal and industrial water.
 - **Flood control:** Two Corps projects demonstrate the ability of dams to reduce the effects of flooding along river courses. Seven Oaks Dam has removed the most massive flooding problem west of the Mississippi River, eliminating a floodplain previously threatening more than 3 million people. Mount Morris Dam provides flood control to the city of Rochester, New York. It is estimated that since its completion in 1952, more than \$1 billion dollars in flood damages have been avoided by the operation of this reservoir. The Corps reported for Fiscal Year (FY) 2003 that almost \$16 billion in flood damage was avoided by the operation of Corps dams. The 10-year average for flood control savings for Corps dams is approximately \$21 billion per year.
 - **Sediment/hazardous materials control:** In some instances, dams provide enhanced environmental protection, such as the retention of hazardous materials and detrimental sedimentation. Dams on the Susquehanna River in Pennsylvania have been instrumental in preventing large-scale pollution of the Chesapeake Bay from sediment. The Susquehanna River contributes about 50 percent of the fresh water supply to the Bay, and also carries 3.1 million tons of sediment each year. Since 1928, over 70 percent of the sediments have been retained by the Holtwood, Safe Harbor, and Conowingo Dams. Thus, the states bordering the Bay have had time to develop better sediment controls to protect the valuable resources of the Bay.
 - **Recreation:** Dams provide prime recreational facilities throughout the United States. There were 105.7 million recreation user days and nights provided at Federal Energy Regulatory Commission (FERC)-licensed hydropower projects in 2002. Ten percent of the U. S. population visits at least one Corps facility each year. Boating, skiing, camping, picnic areas, and boat launch facilities are all supported by dams.
 - **Navigation:** Dams and locks provide for a stable system of inland river transportation throughout the heartland of the Nation. For example, the Corps navigation projects in the United States serve 41 states, maintain 12,000 miles of channels, carry 20 percent of freight on inland waterways, operate 275 locks, and maintain 926 harbors. Nearly 2,600 companies operate vessels on waterways, with nearly 2.4 billion tons of goods. Seventy percent of America’s grain exports are barged along the Mississippi River to the Gulf of Mexico. More than \$13 billion dollars worth of food and goods are barged through 8 locks and dams on the lower Columbia River. A 15-barge tow carries the equivalent of 2.75 miles of trains or 870 semi-trucks. The waterways provide the least cost and most environmentally sustainable method of commodity transport. In addition to financial savings, transport on waterways produces less emissions and less noise and results in less fuel consumption and less wear on rail and highways.
 - **Mine tailings impoundments:** There are more than 1,300 mine tailings impoundments in the United States that allow the mining and processing of coal and other vital minerals while protecting the environment. These impoundments are privately owned and their safe design, operation, and maintenance are regulated by the Department of Labor (DOL), Mine Safety and Health Administration (MSHA).
- The benefits of dams, however, are countered by the risks they can present. In the event of a dam failure, the potential energy of the water stored behind even a small dam is capable of causing loss of life, great property damage, and an extended period of denial of the services dams provide.
- A series of dam failures in the 1970’s caused the Nation to focus on inspecting and regulating these important structures. On February 26, 1972, a tailings dam owned by the Buffalo Mining Company in Buffalo Creek, West Virginia failed, devastating a 16-mile valley with 6,000 inhabitants. In a

matter of minutes, 125 people were killed, 1,100 people were injured, and over 3,000 were left homeless. The flood demolished 502 houses and 44 mobile homes and damaged close to 1,000 houses and mobile homes. On June 5, 1976, Teton Dam, a 123-meter high earthfill dam on the Teton River in Idaho, failed, causing \$1 billion in damage and leaving 11 dead. Over 4,000 homes and over 4,000 farm buildings were destroyed as a result of the Teton Dam failure. Other damage included 100,000 acres of farmland inundated and 427,000 acres of land left without irrigation. In November 1977, Kelly Barnes Dam in Georgia failed, killing 39 people, most of them college students. Despite the significant strengthening of dam safety programs since the 1970's, dams continue to fail, causing millions of dollars worth of damage and occasional deaths.

The NID contains the most up-to-date information about the number of dams in the United States and is maintained and updated by the Corps under the authority of the Dam Safety and Security Act of 2002. The current NID, which is the result of an evolutionary process, is a computerized database of dams in the United States that is used to track information on the water control infrastructure. The NID update process involves a partnership of 68 states, territories, and federal agencies. The most current update to the NID (February 2005) lists approximately 79,500 dams in the United States. The number of dams reported in the NID includes dams in the U.S. territories of Guam and Puerto Rico, but does not include dams located in Canada and Mexico.

To be listed in the NID, a dam must be over 25 feet in height or have an impounding capacity for maximum storage of 50 acre-feet or more. The NID does not include (1) levees; (2) barriers that are 6 feet or less in height, regardless of storage capacity; (3) barriers that have a storage capacity at the maximum water storage elevation that is 15 acre-feet or less regardless of height, unless the barrier, because of the location of the barrier or another physical characteristic of the barrier,

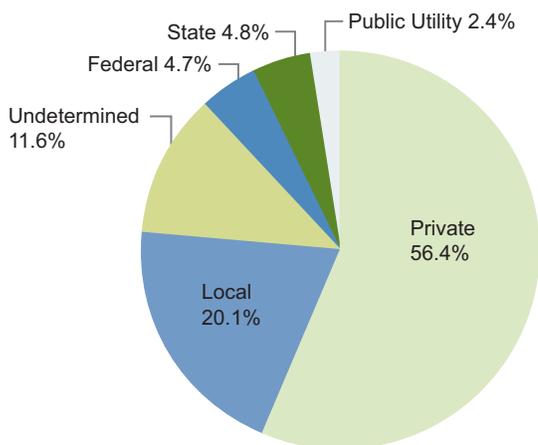
is likely to pose a significant threat to human life or property if the barrier fails; (4) some types of navigation locks; (5) canal structures; and (6) some types of mine tailings dams.

In the NID, downstream hazard potential classifications of high, significant, or low are assigned to each dam to identify the risk or amount of damage dams can pose due to failure or mis-operation. As of the most current update to the NID, there were approximately 11,800 dams in the United States classified as high-hazard potential, meaning that their failure from any means, including a terrorist attack, could result in at least one loss of life, significant property damage, lifeline disruption, and environmental damage.

Dam owners are responsible for the safety and the liability of the dam and for financing its upkeep, upgrade, and repair. The majority of dams in the United States (56 percent) are owned by private entities. Local governments own and operate the next largest numbers of dams (approximately 20 percent). State ownership is next at about 5 percent and the Federal Government, public utilities, and undetermined interests each own smaller percentages of dams.

In general, very large dams are owned and regulated by the Federal Government. Companies or cooperatives privately own most medium-sized dams used for irrigation, water supply, hydroelectric power, and direct hydropower, *e.g.*, for mills. A small percentage of large and medium-sized structures are non-federal hydropower dams licensed by FERC. Almost all small dams are privately owned, although some are owned by state, federal, or local authorities. Structures of this size were constructed primarily for water diversion and irrigation purposes, to generate locally marketed hydroelectric power, to improve navigation on small and medium-sized streams, or to power machinery directly. Other small dams were constructed for recreational purposes.

Dam Owners by Type



Dams By Primary Purpose

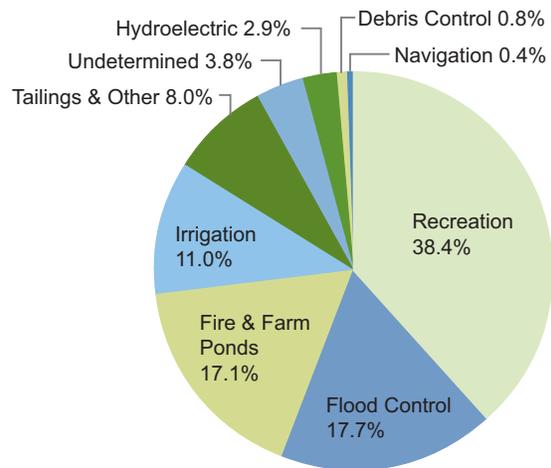


Figure 1: Ownership and Purpose of Dams in the United States

Source: National Inventory of Dams, February 2005

The Federal Emergency Management Agency (FEMA)

Given the diffuse nature of dam ownership versus regulation in the United States, it is apparent that dam safety and security are often not solely a federal, state, or local issue. The safety and security of a dam 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. As a result, there is a reasonable federal role to coordinate federal, state, and local efforts to provide dam safety and security to citizens.

Under the direction of the Department of Homeland Security (DHS), FEMA, 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 (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 and Public Law 107-310, the 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 Review Board also helps oversee the development and support of state dam safety programs by reviewing state progress toward meeting all of the criteria listed in the Dam Safety and Security Act of 2002, assisting FEMA in the review of state dam safety programs, and establishing the reasonable costs of implementing a state dam safety program.

The membership of the Review Board includes the representative from FEMA (the Chair of the Board); 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 the private sector.

The primary mechanism for planning and implementing the majority of work conducted under the National Dam Safety Program are the Work Groups that operate under the Review Board. Four standing Work Groups were established in FY 2004 to address the priorities of the Dam Safety and Security Act of 2002: (1) Dam Safety Research Work Group; (2) Dam

Safety Training Work Group; (3) Work Group on the NID; and (4) Dam Security Work Group. To address specific projects or requirements, the Review Board has established Task Groups and Steering Committees.

Activities conducted by the Review Board in FY 2004 and 2005 are described below according to the programmatic area addressed by the Work Groups and Task Group.

Interagency Committee on Dam Safety

ICODS, which was established in 1980 and meets quarterly, encourages the establishment and maintenance of effective federal programs, policies, and guidelines to enhance dam safety, and serves as the permanent forum for the coordination of federal activities in dam safety. Until January 2003, ICODS was responsible for overseeing and coordinating the majority of federal and state activities conducted under the National Dam Safety Program through its Subcommittees. This oversight and coordination role passed to the Review Board with the enactment of the Dam Safety and Security Act of 2002. However, with the establishment of DHS and the requirements of Homeland Security Presidential Directive-7 (HSPD-7) for DHS to develop and implement a National Infrastructure Protection Plan (NIPP), there is the need to harmonize efforts between ICODS, the Review Board, and the Government Coordinating Council (GCC) and the Sector Coordinating Council (SCC) being established pursuant to the NIPP.

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

- U.S. Department of Agriculture
- Department of Defense
- Department of Energy
- Department of the Interior
- Department of Labor, Mine Safety and Health Administration
- Department of Homeland Security, Federal Emergency Management Agency
- Federal Energy Regulatory Commission
- Department of State, International Boundary and Water Commission (U.S. Section)
- Nuclear Regulatory Commission
- Tennessee Valley Authority

In FY 2005, ICODS established two new subcommittees: the Subcommittee on Risk Assessment and the Subcommittee on Federal Training Resources. The work of these two Subcommittees also will be harmonized with the efforts of similar subcommittees of the GCC and SCC being established pursuant to the NIPP.

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, President Clinton’s designation of mitigation as the

cornerstone of the federal multi-hazard emergency management system, and President Bush’s issuance of HSPD-7 for the protection of national critical infrastructure, including dam security, further emphasized the need for a National Dam Safety 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.

Table 1: Summary Status of Dams for Federal Agencies (FY 2004–2005)

DEPT. Agency	DAM INVENTORY				PERIODIC INSPECTIONS			
	Total	Hazard Classification			Total	Since Last Report		
		High	Sig.	Low		Formal	Inter.	Spec/Const
USDA (Total)	27852	1860	2390	22975	15531	2160	13171	200
ARS	1	-	-	1	1	-	1	-
USFS	1070 ¹	55	113	902	-	-	-	-
NRCS	26781 ²	1805	2277	22072	15530 ³	2160	13170	200
RHS	25 ⁴	-	-	-	-	-	-	-
RUS	55 ⁵	-	-	-	-	-	-	-
DOD (Total)	900	504	151	245	936	210	1152	16
USACE	631 ⁶	467	118	46	828	189	1065	16
Army	212	32	24	156	88	15	73	-
Navy	33	5	3	25	6	6	-	-
Air Force	24	-	6	18	14	-	14	-
DOE	15	2	1	12	15	15	-	-
DOI (Total)	1982	365	106	1511	2337	281	538	1519
BIA	425	88	37	300	76	36	21	19
BLM	515	8	1	506	146	-	146	-
BOR	310 ⁷	236	9	65	641	157	335	149 ⁸
USFWS	193	12	21	160	87	87	N/A ⁹	N/A ¹⁰
NPS ¹¹	538	20	38	480	38	-	36	2
OSM	-	-	-	-	-	-	-	-
USGS	1	1	-	-	1	1	-	-
FERC	2530	760	207	1563	3412	352	2449	348/263
IBWC	7	3	1	3	336	-	336	-
MSHA (Total)	1395	279	240	876	5939	5939	-	-
Coal	734	249	194	291	2857	2857	-	-
M/NM	661	30	46	585	3082	3082	-	-
NRC	14	-	-	14	-	-	-	-
TVA	82¹³	63	15	4	1176¹⁴	49	125	54

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 United States that are included in the NID. USDA dams provide livestock water, municipal water and wastewater, electric power, flood protection, irrigation, fish and wildlife habitat, recreation, sediment detention, and manure storage and treatment. There are five agencies within the USDA involved with dams.

Agricultural Research Service (ARS) conducts internationally recognized research in hydrologic, hydraulic, erosion, and sedimentation processes applicable to dams. ARS currently owns and operates only one NID-size dam at one ARS research facility, and it may be decommissioned in the near future. ARS utilizes Natural Resources Conservation Service (NRCS) engineering assistance as needed for the inspection and maintenance of its dam.

INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAP'S	
04-05	Active	04-05	Active	High	Sig.
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
70	100	30	70	596	170
-	-	-	-	-	-
-	-	-	-	-	-
9	21	14	31	481	65
6	16	4	28	450	53
-	-	4	3	30	12
3	2	4	-	1	-
-	3	2	-	-	-
-	-	1	1	2	1
-	-	-	-	-	-
41	24	8	3	58	8
-	-	8	1	1	-
119	22	10	4	236	9
11	9	6	2	12	21
15	15	6	1	0 ¹²	0 ¹²
-	-	-	-	-	-
1	-	-	-	1	-
141	139	47	77	760	207
3	-	-	-	3	1
9	-	-	-	84	72
5	-	-	-	75	58
4	-	-	-	9	14
-	-	-	-	-	-
1	3	1	1	63 ¹⁵	15

- 1 Dams owned by FS; approximately 1,330 non-FS dams are also on FS lands.
- 2 Dams designed and/or funded by NRCS, includes dams with unknown hazard classifications.
- 3 Inspections are performed by NRCS and non-NRCS organizations.
- 4 Dams with active loans in RHS portfolio.
- 5 Dams financed by RUS.
- 6 Includes 14 dams owned by others in which the Corps of Engineers has a substantial interest in the O&M of the dam.
- 7 BOR has 479 dams and dikes that are located at 310 individual facilities. Of the 310 facilities, 245 are classified as high- or significant-hazard potential facilities. The facility count is used for this presentation. Inspections, investigations, modifications, and EAP's are counted and reported by facility.
- 8 Total only includes special examinations. BOR performs quality assurance and construction administration activities on an ongoing basis for all dams and dam construction activities.
- 9 Not applicable: FWS performs intermediate inspections on an ongoing basis.
- 10 Not applicable: FWS performs quality assurance and construction administration activities on an ongoing basis for all dams and dam construction activities.
- 11 No nationwide survey, status report, or updating of inventory of dams and other streamflow control structures since 1993.
- 12 No current or complete EAP's known.
- 13 Includes 49 main dam projects; the 82 listed above includes saddle dams and dikes.
- 14 Civil, Mechanical, and Electrical are considered separate inspections.
- 15 Saddle dams and dikes will be included in main dam EAP's. Some EAP's will apply to more than one dam in a project.

U.S. Forest Service (FS) designs, finances, constructs, owns, operates, maintains, and regulates dams in conjunction with the management of national forests and grasslands. FS owns approximately 700 NID-size dams and administers permits for approximately 2,000 privately owned NID-sized dams. For the permitted dams, the dam owner designs, constructs, and operates the dam, and FS reviews and approves activities related to the safety of the dam.

Natural Resources Conservation Service 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 almost 27,000 NID-size dams and financial assistance for over 11,000 of these dams.

USDA Rural Development Housing and Community Programs is authorized to finance dams through loans, loan guarantees, and grants to public entities, local organizations, and non-profit corporations for rural community facilities. The agency does not design, construct, own, or operate dams. Less than 30 NID-size dams are financed under this program.

USDA Rural Utilities Programs 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. USDA Rural Utilities Programs also finances dams through loans, loan guarantees, and grants to rural communities under its Water and Waste Program for water and wastewater facilities. Less than 60 NID-size dams are financed under the USDA Rural Utilities Programs.

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 24 dams.

Department of the Army is responsible for dams that are either on Army installations or controlled by Army installations. The Army has jurisdiction over 212 dams.

Department of the Navy has dam safety responsibility for dams located on Navy bases. There are 33 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 that the Corps planned, designed, constructed, and operates; (2) dams that the Corps designed and constructed, but are operated and maintained by others; (3) those non-Corps 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 is responsible for proscribing the regulations for the use of storage allocated to flood control and/or navigation; (4) dams for which the Corps issues permits under its regulatory authority; and (5) dams that the Corps 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 has responsibility for 237 navigation locks, 25,000 miles of commercial navigation channel, and approximately 1,200 Civil Works projects of varying types, including 631 dams, 75 that include Corps hydropower plants and 67 non-federal power plants. The Corps owns and is responsible for approximately 4,000 miles of levees.

The **Department of Energy** owns and has jurisdiction over 15 dams, as defined in the *Federal Guidelines for Dam Safety*, at 3 sites.

As the Nation's principal conservation agency, the **Department of the Interior** 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 nearly 2,000 dams meeting the definition in the *Guidelines*.

Bureau of Indian Affairs works with the American Indian Tribes to operate and maintain its 425 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 DOI BLM dam inventory consists of 515 NID dams.

Bureau of Reclamation is a federal water resource management and development bureau authorized to operate in 17 Western States. In carrying out its mission, DOI Reclamation has developed water resource projects where dams play a major role in the viable development of the resources. DOI Reclamation has reservoirs impounded by 479 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 DOI FWS has an inventory of 193 dams.

National Park Service (NPS) manages 538 stream-flow control structures and monitors the status of 266 non-DOI NPS structures which are within or adjacent to park boundaries. An important aspect of the DOI 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. DOI NPS is recognized as a leader in the deactivation of dams as a method of resolving problems with dams. To date, DOI NPS has deactivated more than 126 dams as part of its corrective action efforts.

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

U.S. Geological Survey owns and maintains one high-hazard potential retention basin embankment dam.

Federal Emergency Management Agency (FEMA) is the lead agency for the National Dam Safety Program and is the Chair of the Review Board and ICODS.

Risk Management Division (RMD) of the DHS Preparedness Directorate is the Sector Specific Agency (SSA) for the Dam Sector. HSPD-7 divided up the Nation's Critical Infrastructure and Key Resources (CI/KR) into 17 Sectors and assigned responsibility for each to an agency within the Federal Government. The SSA's were given oversight responsibility for their assigned sectors, which includes responsibility for developing sector-specific components of the NIPP. As the SSA for the Dam Sector, RMD is tasked with overseeing and coordinating the overall progress of protective actions for the Dam Sector and ensuring that progress contributes to overarching national protective strategies designed to achieve greater critical infrastructure protection.

Science and Technology Directorate (S&T) has responsibility to develop risk reduction technologies to assist all critical infrastructure sectors, including dams.

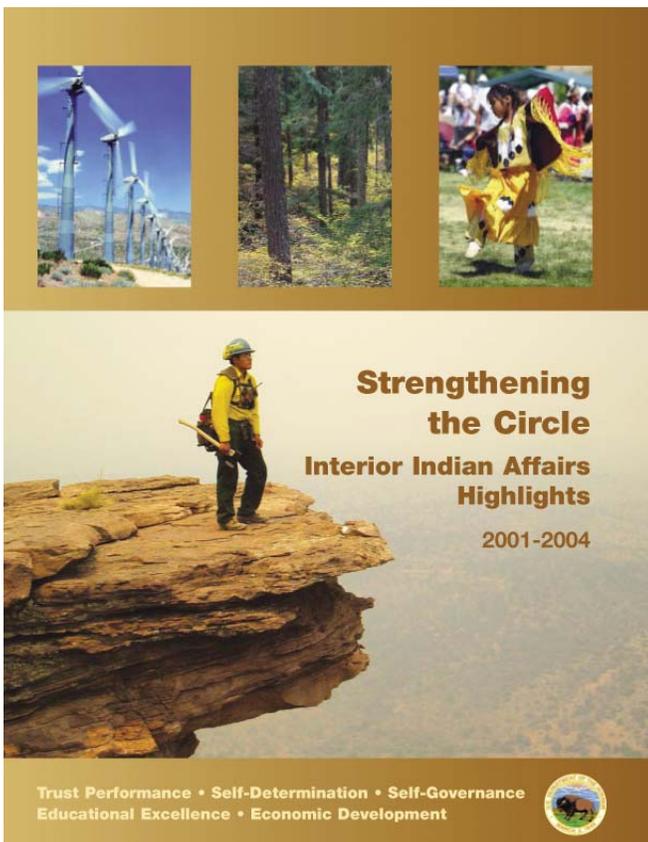
The **Department of Homeland Security** has dam safety and security responsibilities but does not actually own or operate any water control infrastructure.

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." MSHA regulates 734 dams under the Coal Mine Safety and Health districts and 661 dams in Metal and Nonmetal Mine Safety and Health districts.

11

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. Section 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** 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;



2001–2004 Report Strengthening the Circle
Interior Indian Affairs Highlights

Photo courtesy U.S. Department of the Interior, Bureau of Indian Affairs

(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, 2005, there were 2,530 dams under FERC jurisdiction

The **Nuclear Regulatory Commission (NRC)** has regulatory authority over one uranium mill tailings dam; storage water pond dams at in-situ leach mining facilities; and 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 NRC regulates 10 low-hazard potential dams.

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 is responsible for the planning, design, construction, operation, and maintenance of its 49 dams.

The States

12 The states have primary responsibility for protecting their populations from dam failure. Of the approximately 79,500 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. Around midnight on March 12, the 188-foot high St. Francis Dam, an arched concrete gravity dam located about 60 miles north of Los Angeles, failed suddenly because of major defects in the two geological formations on which the dam was founded, weak conglomerate on the right abutment, and a large, active slide on the left abutment. 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 one state has adopted dam safety regulatory laws. As noted above, Alabama continues to work on enacting state dam safety legislation.

Since its founding in 1984, ASDSO has moved to a leadership role in dam safety. There are four regions active in the support of the Association (Western, Southeast, Northwest, and Midwest), 49 full voting members including Puerto Rico, and over 2,200 members when Associate, Affiliate, and Student members are included. ASDSO was very active in FY 2004 and 2005 with activities undertaken on behalf of the states and with initiatives funded under the National Dam Safety Program. The activities are described below in *The National Dam Safety Program in 2004 and 2005*.

The Private Sector

Many organizations are involved in dam safety and security. For example, 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 and has served as the private sector member of the Review Board since its establishment in 1998.

There are many national and international organizations with interests in dam safety. Some of these organizations are listed below.

National and International Organizations

- American Consulting Engineers Council
- American Public Works Association
- American Rivers
- American Society of Civil Engineers
- Associated General Contractors of America, Inc.
- Association of State Floodplain Managers
- Earthquake Engineering Research Institute
- Electric Power Research Institute
- Institute for Business and Home Safety
- 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 Society of Professional Engineers
- National Watershed Coalition
- Portland Cement Association



Clear Creek Dam, WA. Photo courtesy U.S. Department of the Interior, Bureau of Reclamation.

The National Dam Safety Program in 2004 and 2005

There have been significant accomplishments in dam safety in Fiscal Year (FY) 2004 and 2005 in state dam safety programs, research, training, and in the continued development and enhancement of tools for data collection and analysis. These and other accomplishments in FY 2004 and 2005 are described below.

The Dam Safety and Security Act of 2002

On December 2, 2002, the Dam Safety and Security Act of 2002 (Public Law 107-310) was signed into law. Section 215 of Public Law 107-310 continues the National Dam Safety Program with the Director of the Federal Emergency Management Agency (FEMA) as its coordinator.

The current National Inventory of Dams contains data on approximately 79,500 dams throughout the United States that are more than 25 feet high, hold more than 50 acre-feet of water, or are considered a significant hazard if they fail.

The Dam Safety and Security Act of 2002

Purpose

The purpose of the National Dam Safety Program, as expressed in Section 215(a) of Public Law 107-310, 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:

- 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;
- encourage acceptable engineering policies and procedures to be used for dam site investigation, design, construction, operation and maintenance, and emergency preparedness;
- encourage the establishment and implementation of effective dam safety programs in each state based on state standards;
- develop and encourage public awareness projects to increase public acceptance and support of state dam safety programs;
- develop technical assistance materials for federal and state dam safety programs;
- develop mechanisms with which to provide federal technical assistance for dam safety to the non-federal sector; and
- develop technical assistance materials, seminars, and guidelines to improve security for dams in the United States.

Initiatives

Public Law 107-310 directs FEMA to carry out a number of initiatives. These initiatives are summarized below:

- Establish a National Dam Safety Review Board to monitor state implementation of Section 215 and advise FEMA on implementation of the National Dam Safety Program.
- Exercise leadership by chairing the Interagency Committee on Dam Safety to coordinate federal efforts in dam safety.
- Transfer knowledge and technical information among the federal and state sectors.
- Provide for the education for the general public, state and local officials, and private industry on the hazards of dam failure and related matters.
- Provide funding to the states to establish and maintain dam safety programs through a grant assistance program.
- Provide training for state dam safety staff and inspectors.
- 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;
 - devices for the continued monitoring of the safety of dams;
 - the maintenance of information resources systems needed to support managing the safety of dams; and
 - initiatives to guide the formulation of effective public policy and advance improvements in dam safety engineering, security, and management.
- Report to Congress (biennially) on the status of the National Dam Safety Program, the progress achieved by federal agencies during the 2 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 National Dam Safety Program goals and objectives.

State Accomplishments

Overview

The National Dam Safety Program empowers the states, through grants and technical resources and training, to enhance their own state programs. The nature of this program allows the states to identify their own priorities where dams are concerned and to take appropriate action according to available resources.

The state assistance program is intended to help states bring the necessary resources to bear on inspection, classification, and emergency planning for dam safety. For a state to be eligible for 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 107-310:

- 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 necessary 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;
- 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 assistance, state appropriations must be budgeted to carry out the legislation of the state. Figure 2 below shows the status of state compliance in 2004 with all of the legislative authorities listed in the Act.

Figure 2: Legislative Authorities in 2004

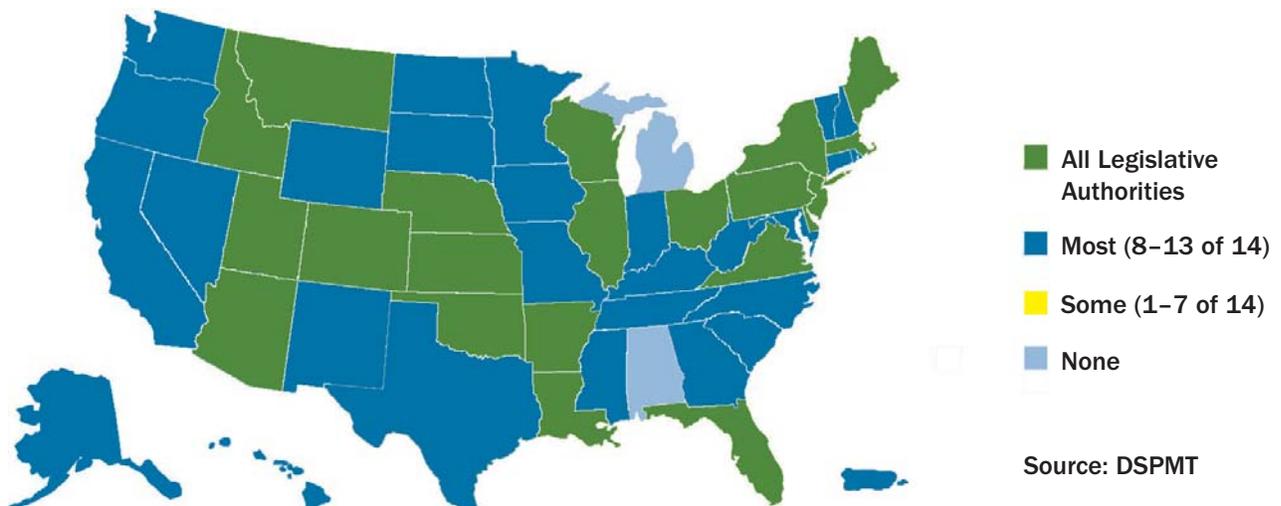


Table 2: State Grant Amounts for FY 2004 and 2005

State	FY 2004/2005 Awards (in combined \$)	State	FY 2004/2005 Awards (in combined \$)
Alabama*	0	Nebraska	187,897
Alaska	49,868	Nevada	75,894
Arizona	62,184	New Hampshire	84,311
Arkansas	95,780	New Jersey	98,534
California	128,324	New Mexico	66,621
Colorado	150,350	New York****	88,481
Connecticut	92,248	North Carolina	214,405
Delaware**	0	North Dakota	97,144
Florida	93,870	Ohio	149,622
Georgia	261,938	Oklahoma	353,296
Hawaii	52,920	Oregon	102,480
Idaho	66,911	Pennsylvania	132,526
Illinois	130,364	Puerto Rico	46,882
Indiana	106,547	Rhode Island	57,197
Iowa	261,029	South Carolina	199,495
Kansas	310,090	South Dakota	200,998
Kentucky	106,483	Tennessee	84,711
Louisiana	66,393	Texas	518,594
Maine	76,178	Utah	89,939
Maryland	64,999	Vermont	66,961
Massachusetts	139,641	Virginia	106,074
Michigan***	50,064	Washington	92,558
Minnesota	99,350	West Virginia	68,376
Mississippi	266,852	Wisconsin****	57,046
Missouri	86,407	Wyoming	136,792
Montana	222,640		

*Alabama does not participate in the program because it does not have a legislatively mandated state dam safety program.

**Delaware has a legislatively mandated state dam safety program but did not fund its program in either FY 2004 or FY 2005.

***Michigan has a legislatively mandated state dam safety program but did not fund its program in FY 2005.

****New York and Wisconsin were eligible for state grant funds but elected not to request state grant funds in FY 2005.

Scope of State Assistance

Table 2 lists the state assistance grant amounts (combined) allocated by FEMA for FY 2004 and 2005.

Highlights in FY 2004 and 2005

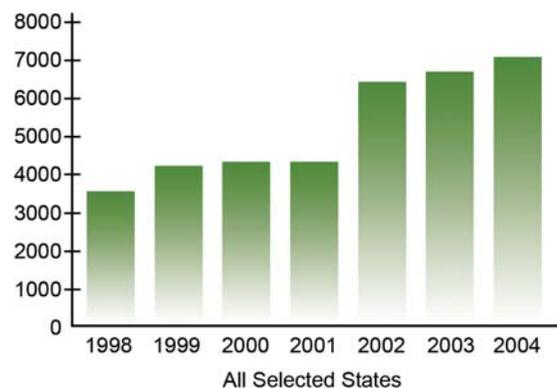
FY 1998 and 1999 was the first period for which the states provided FEMA with data on the number of dams in their states by hazard classification; the number of dam inspections conducted each year; remediation needs; and the status of dams with Emergency Action Plans (EAP's) by hazard potential classification. Table 3 compares by state the percent of EAP's by state-regulated high- and significant-hazard potential dams for FY 2004 against the data provided for FY 2002.

A comparison of data from the states for 2002 indicates that National Dam Safety Program funding has contributed to increases in the number of EAP's over the past 2 years. Today, 39 percent of all state-regulated high- and significant-hazard potential dams have an EAP. Of the states reporting in 2004, 22 states increased the number of EAP's for high- and

significant-hazard potential dams, 17 states reported no change, and 11 states reported a decrease. Of particular note are the increases in EAP's by Alaska, Kansas, Nevada, New Jersey, Puerto Rico, Utah, Vermont, and Washington.

Figures 3 and 4 show the increase in EAP's for state-regulated dams for all hazard potentials and EAP's for high-hazard

Figure 3: Number of State-Regulated Dams with EAP



Source: DSPMT

Table 3: Percent of EAP's by State-Regulated High- and Significant-Hazard Potential Dams

State	FY 02 Percent	FY 04 Percent	% Change	State	FY 02 Percent	FY 04 Percent	% Change
Alabama*	0	0	0	Nebraska	31	33	+2
Alaska	30	40	+10	Nevada	10	30	+20
Arizona	68	70	+2	New Hampshire	84	82	-2
Arkansas	39	42	+3	New Jersey	59	71	+12
California	100	100	0	New Mexico	5	5	0
Colorado	100	100	0	New York	20	20	0
Connecticut	42	42	0	North Carolina	8	11	+3
Delaware**	0	25	+25	North Dakota	2	2	0
Florida	99	99	0	Ohio	22	26	+4
Georgia	4	4	0	Oklahoma	58	65	+7
Hawaii	17	12	-5	Oregon	29	29	0
Idaho	53	53	0	Pennsylvania	79	79	0
Illinois	55	58	+3	Puerto Rico	31	97	+66
Indiana	3	1	-2	Rhode Island	0	0	0
Iowa	0	0	0	South Carolina	100	100	0
Kansas	21	33	+12	South Dakota	18	21	+3
Kentucky	0	1	+1	Tennessee	42	44	+2
Louisiana	16	10	-6	Texas	6	5	-1
Maine	45	45	0	Utah	26	59	+33
Maryland	70	66	-4	Vermont	10	22	+12
Massachusetts	8	15	+7	Virginia	97	67	-30
Michigan	80	86	+6	Washington	37	51	+14
Minnesota	16	16	0	West Virginia	61	36	-25
Mississippi	4	9	+5	Wisconsin	26	26	0
Missouri	9	7	-2	Wyoming	20	19	-1
Montana	42	41	-1				

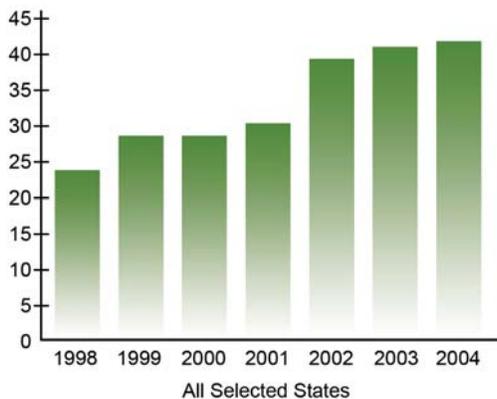
*Did not submit data.

**Did not submit data for the last biennial report.

potential dams and significant-hazard potential dams from 1998, the first year of National Dam Safety Program funding, through 2004 (data for 2000 was incomplete). The data indicates that approximately 3,600 dams (all hazards) had EAP's in 1998, compared to just over 7,000 dams in 2004. This is a good indication that National Dam Safety Program funding is making steady progress in realizing one of the most important goals for our Nation's dams: an EAP for 100 percent of all high- and significant-hazard potential dams.

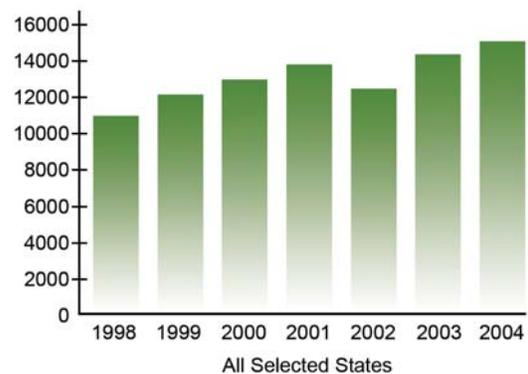
The number of dam inspections conducted by the states remained fairly constant with the last reporting period, but has increased dramatically since data was first collected for 1998-1999, from a total of approximately 12,000 inspections for 1998-1999 to nearly 15,000 inspections for 2004. Figure 5 below shows dam inspections for all hazard potential dams for 1998 through 2004. Table 4 shows the summary status of state dam safety programs for the year ending in FY 2004.

Figure 4: EAP Completion Percentage for High- and Significant-Hazard Potential Dams



Source: DSPMT

Figure 5: Total Number of Inspections of State-Regulated Dams



Source: DSPMT

Table 4: Summary Status of State Dam Safety Programs for the Year Ending in FY 2004

State	# State Regulated NID Dams				Total # State Regulated Dams			
	Total	High	Sig	Low	Total	High	Sig	Low
Alabama	0	0	0	0	0	0	0	0
Alaska	77	18	32	27	82	18	32	32
Arizona	258	87	46	125	259	94	41	124
Arkansas	403	102	92	209	403	102	92	209
California	1259	336	712	211	1259	336	712	211
Colorado	1880	335	312	1233	1880	335	312	1233
Connecticut	706	226	452	28	1187	226	462	499
Delaware	37	9	27	1	37	9	27	1
Florida	773	101	259	413	773	101	259	413
Georgia	4409	500	0	3909	3824	400	0	3424
Hawaii	134	77	21	36	134	77	21	36
Idaho	363	93	128	142	429	95	143	191
Illinois	1282	184	297	801	1464	184	297	983
Indiana	952	241	243	468	1081	241	243	597
Iowa	3219	74	189	2956	3219	74	189	2956
Kansas	5912	193	257	5462	5912	193	257	5462
Kentucky	945	160	192	593	1040	176	212	652
Louisiana	498	16	62	420	497	15	62	420
Maine	699	59	95	545	655	26	84	545
Maryland	357	65	77	215	370	65	78	227
Massachusetts	1619	324	741	554	2506	296	682	1528
Michigan	771	81	137	553	987	79	133	775
Minnesota	730	24	127	579	1202	24	127	1051
Mississippi	3474	310	81	3083	3629	310	81	3238
Missouri	647	449	132	66	647	449	132	66
Montana	2629	102	130	2397	2879	102	130	2647
Nebraska	2212	117	249	1846	2212	117	249	1846
Nevada	402	121	106	175	610	131	122	357
New Hampshire	628	88	190	350	847	88	190	569
New Jersey	797	200	373	224	1698	200	373	1125
New Mexico	344	156	95	93	392	165	95	132
New York	1891	379	776	736	1891	379	776	736
North Carolina	2766	1083	674	1009	4713	1083	695	2935
North Dakota	761	28	92	641	1120	28	92	1000
Ohio	1519	412	548	559	1662	412	548	702
Oklahoma	4460	187	82	4191	4460	187	82	4191
Oregon	833	122	181	530	1204	122	181	901
Pennsylvania	1342	776	239	327	3090	776	239	2075
Puerto Rico	35	35	0	0	35	35	0	0
Rhode Island	194	17	41	136	563	17	41	505
South Carolina	2313	153	481	1679	2313	153	481	1679
South Dakota	2323	47	144	2132	2323	47	144	2132
Tennessee	620	147	202	271	638	147	202	289
Texas	7492	817	807	5868	7492	817	807	5868
Utah	573	192	197	184	658	192	197	269
Vermont	351	55	134	162	563	55	132	376
Virginia	1379	131	273	975	1379	131	273	975
Washington	599	140	191	268	935	140	191	604
West Virginia	351	267	75	9	477	366	101	10
Wisconsin	987	187	149	651	3491	197	201	3093
Wyoming	1320	79	115	1126	1401	79	116	1206
Totals	70525	10102	11255	49168	82522	10091	11336	61095

Total	# of Inspections			#EAP's	
	High	Sig	Low	High	Sig
0	0	0	0	0	0
22	5	11	6	11	9
58	31	9	18	71	26
108	44	30	34	81	0
1724	496	952	276	334	709
562	239	163	160	325	316
23	3	19	1	162	125
2	1	0	1	9	0
1050	150	700	200	101	256
1305	400	0	905	14	0
72	58	5	9	12	0
204	34	65	105	90	37
210	83	60	67	163	116
331	133	110	88	5	0
62	26	15	21	0	0
123	66	53	4	135	14
299	95	92	112	4	1
173	10	43	120	6	2
77	18	29	30	21	28
135	53	29	53	58	38
156	45	56	55	101	45
209	31	28	150	73	110
37	12	15	10	24	0
105	76	8	21	32	2
95	66	19	10	25	15
24	24	0	0	96	0
797	50	82	665	111	8
288	133	43	112	72	4
166	32	41	93	87	141
310	71	149	90	190	214
135	89	33	13	13	0
493	196	230	67	182	53
2230	669	312	1249	182	17
187	11	88	88	2	1
75	64	7	4	146	107
682	180	79	423	145	30
137	21	35	81	72	15
1957	1346	93	518	679	118
12	12	0	0	34	0
162	0	2	160	0	0
199	43	156	0	153	481
81	17	7	57	30	6
388	160	120	108	147	5
126	65	24	37	71	11
344	192	98	54	180	50
80	29	25	26	13	29
131	49	47	35	116	153
51	28	18	5	111	57
295	206	84	5	126	40
88	30	12	46	87	16
263	15	24	224	33	5
16843	5907	4320	6616	4935	3410

Each step on the road to dam safety is a success, and all of the states that have received National Dam Safety Program grant funds in FY 2004 and 2005 have achieved successes, whether through increases in emergency action planning and inspections, dam owner awareness programs, or the implementation of safeguards for dams. Listed below are some of the accomplishments of the states with National Dam Safety Program funds in FY 2004 and 2005.

Accomplishments with State Assistance Funds in FY 2004 and 2005

- Dam safety-related training for state personnel
- Improvements in security and safeguards for dams
- Training of dam owners to conduct annual maintenance reviews
- 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; surveying equipment; and vehicles for use in inspections
- Revision of state operations and maintenance guidelines
- Increase in the number of dam inspections
- Increase in the submittal of EAP's
- More timely review and issuance of permits
- The testing of EAP procedures through actual simulations of dam failures
- Improved coordination with state emergency preparedness officials
- Improvements to dam inventory databases
- Improved telecommunications
- Identification of dams to be repaired or removed
- Conduct of dam safety awareness workshops
- Development of proposals to strengthen dam safety rules
- Creation of dam safety videos and other outreach materials
- Development of public relations plans and dam safety newsletters

Research

Research is critical to the Nation's agenda for dam safety and security. Research funding under the National Dam Safety Program has addressed a cross-section of issues and needs, all in support of ultimately making dams in the United States safer.

In April 1999, the first full year of National Dam Safety Program funding, the Interagency Committee on Dam Safety (ICODS) Research Subcommittee, now the Review Board Dam Safety Research Work Group, identified 17 broad area topics related to the research needs of the dam safety community. Over the past 6 years, research funds have been allocated to hold workshops in nine of the priority areas identified. Based on the results from the workshops, research topics have been proposed and pursued. Several topics have progressed to products of use to the dam safety community, such as technical manuals and guidelines.

The following research needs workshop reports were posted to the FEMA National Dam Safety Program website (www.fema.gov/plan/prevent/damfailures/publications.shtm) in FY 2005:

- *Research Needs Workshop: Impacts of Plants and Animals on Earthen Dams*, November 30–December 2, 1999, Knoxville, Tennessee, Organized and Conducted by ASDSO, FEMA 540CD, September 2005
- *Research Needs Workshop: Spillway Gates*, January 5–6, 2000, Palo Alto, California, Organized and Conducted by ASDSO and EPRI, FEMA 537CD, September 2005
- *Research Needs Workshop: Risk Assessment for Dams*, March 7–9, 2000, Logan, Utah, Organized and Conducted by ASDSO and Utah State University, January 2001
- *Research Needs Workshop: Seepage through Embankment Dams*, October 17–19, 2000, Denver, Colorado, Organized and Conducted by ASDSO and URS Greiner Woodward Clyde, FEMA 535CD, September 2005
- *Research Needs Workshop: Embankment Dam Failure Analysis*, June 26–28, 2001, Oklahoma City, Oklahoma, Organized and Conducted by ARS, FEMA 541CD, September 2005
- *Research Needs Workshop: Hydrologic Issues for Dams*, November 2001, Davis, California, Organized and Conducted by the U.S. Army Corps of Engineers, Hydrologic Engineering Center, FEMA 538CD, September 2005
- *Research Needs Workshop: Dam Spillways*, August 26–27, 2003, Denver, Colorado, Organized and Conducted by the Bureau of Reclamation, FEMA 536CD, September 2005

The two remaining research needs workshop reports (*Research Needs Workshop: Seismic Ground Motions* and *Research Needs Workshop: Outlet Works*) will be published in FY 2006.

In addition to the research needs workshop reports, technical manuals and brochures published in FY 2005 include the following:

- *Technical Manual for Dam Owners: Impacts of Animals on Earthen Dams*, FEMA 473, September 2005 (published in print, CD, and on web)
- *Technical Manual for Dam Owners: Impacts of Plants on Earthen Dams*, FEMA 534, September 2005 (published in print, CD, and on web)
- *Technical Manual for Dam Owners: Conduits through Embankment Dams*, FEMA 484, September 2005 (published in print, CD, DVD, and on web)
- *Technical Manual: Conduits through Embankment Dams (Executive Summary)*, September 2005 (published on web)
- *Dam Owner's Guide to Impacts of Animals on Earthen Dams*, FEMA L-264, September 2005 (published in print and on web)
- *Dam Owner's Guide to Impacts of Plants on Earthen Dams*, FEMA L-263, September 2005 (published in print and on web)

There also were a number of ongoing and very successful initiatives conducted under the direction of the Research Work Group in FY 2005. To establish an effective and efficient research program, the ICODES 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. The effort, which began in 1999, continues today. The Bibliography is updated on a weekly basis and is fully searchable online at ASDSO's web site at www.damsafety.org.

In FY 2005, FEMA provided a new Dam Seepage Monitoring System software at no cost to state dam safety officials and dam owners and operators. The new version updates a version released in 2000 and offers improved data entry, plotting, reporting, and installation features. Dam safety engineers and owners of small- to medium-sized dams can use the Dam Seepage Monitoring System to manage data associated with long-term performance monitoring. The new desktop version 2.0 can be downloaded from the ASDSO web site at www.damsafety.org.

Other ongoing research initiatives include research in embankment dam failure analysis being conducted by the U.S.

Department of Agriculture, Agricultural Research Service (a summary paper was published in a recent ASDSO journal), Phase II of the risk assessment categorization project, and work with the European Union on dambreak coordination. Research projects initiated in FY 2005 with NDSP funds include two U.S. Army Corps of Engineers (Corps) projects to develop guidance on geotextiles and granular filters.

The new ICODS Subcommittee on Risk Assessment, which met for the first time in July 2005, will develop and maintain collaborative activities to implement risk-based approaches in federal agency dam safety programs. For FY 2006, the Subcommittee has identified the following initiatives: identification of low-hazard potential dams; review of the risk categorization project and beta testing at the federal level; and education on risk assessment.

In FY 2005, the ICODS Guidelines Development Subcommittee completed work on the update to the *Federal Guidelines for Dam Safety: Earthquake Analyses and Design of Dams*, FEMA 65, September 2005. With the completion of the update, this Subcommittee was formally dissolved. In FY 2004, a new Earthquake Guidelines Task Group was established to develop new Federal Earthquake Guidelines. These Guidelines will be completed in FY 2007.

Training

Since the inception of the National Dam Safety Program in 1979, FEMA has supported a strong, collaborative training program for both dam safety professionals and dam owners. With the training funds provided under the 1996 Act and the Act of 2002, FEMA has expanded existing training programs, begun new initiatives to keep pace with evolving technology, and enhanced the sharing of expertise between the federal and state sectors.

The training activities conducted under the National Dam Safety Program fall under one of three stages: national training opportunities, most of which are conducted at FEMA's Emergency Management Institute (EMI); regional training that is conducted by ASDSO and other private vendors; and local training through direct assistance to the states and self-paced training. Training activities conducted in FY 2004 and 2005 under the direction of the Review Board, the Training Work Group, and ICODS are described below.

National Training Initiatives

A major training initiative is the National Dam Safety Program Technical Workshop Series. The idea for a series of technical workshops originated with 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. Over the years, the Technical Workshops have hosted a pre-eminent roster of speakers on topics such as liquefaction susceptibility, mitigation strategies for dam safety, dam breach analysis and maximum precipitation, and spillway gates. For the last 6 years, training funds have been set aside for state dam safety officials to attend the Workshops. To date, 12 Technical Workshops have been held.

In February 2004, Technical Seminar #11, Hydrologic Deficiencies, was held at FEMA's EMI. Over 180 participants from academia and state, federal, and private sector organizations attended the Seminar. In February 2005, Technical Seminar No. 12, Addressing Potential Failure Mode Analysis and Monitoring, was held at EMI. Over 175 state and federal dam safety officials attended the course. Technical Seminar No. 13, Implementation of Remedial Measures, will be held at EMI on February 22-23, 2006.

HEC-RAS is the Corps Hydrologic 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 Hydrologic Modeling System (HMS), designed to simulate the precipitation runoff processes of dendrite watershed systems. Hands-on computer training in both HEC-RAS and HEC-HMS has been a priority for state training. Each year, the National Dam Safety Program supports a HEC-RAS course and a HEC-HMS course for approximately 25 students at EMI. A Beginning HEC-HMS course was held at EMI in May 2004 and in January 2005 and an Advanced HEC-RAS course was held at EMI in January 2004 and May 2005.

Every other year, FEMA provides National Dam Safety Program training funds to EMI to support the Multi-Hazard Building Design Summer Institute (MBDSI) course in dam safety. The MBDSI courses are updated on a yearly basis to support engineering and architectural faculty. In June 2004, the MBDSI dam safety course was held at EMI. The next MBDSI dam safety course will be held at EMI in June 2006.

ASDSO Regional Training

For many years, ASDSO has been FEMA's most important partner in the National Dam Safety Program. Each year, in addition to its annual conference, ASDSO conducts a number of regional technical seminars. In FY 2004 and 2005, ASDSO held the following regional technical seminars:

- ASDSO Northeast Regional Technical Seminar on Soil Mechanics for Dam Safety, November 2003
- ASDSO Southeast Regional Technical Seminar on Soil Mechanics for Dam Safety, December 2003
- ASDSO Western Regional Technical Seminar on Soil Mechanics for Dam Safety, March 2004
- ASDSO Midwest Regional Technical Seminar on Plant and Animal Penetrations of Earthen Dams, May 2004
- ASDSO Northeast Regional Technical Seminar on Safety Evaluation of Existing Dams, November 2004
- ASDSO Southeast Regional Technical Seminar on Safety Evaluation of Existing Dams, December 2004
- ASDSO Western Regional Technical Seminar on Hydraulic Analysis of Spillways, February 2005

In addition to the regional technical seminars, ASDSO sponsored Advanced Technical Seminars in Seepage for Earth Dams in Davis, California (July 2004) and in Atlanta, Georgia (October 2004) and an Advanced Technical Seminar on Dam Failure Analysis in July 2005.

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Local and Self-Paced Training

Training funds for state dam safety officials have been a mainstay of the National Dam Safety Program. Each year, an amount is provided directly to state officials to cover the costs of attending technical training identified by the individual states. This flexibility allows the states to focus their training on their specific needs.

One of the most successful training initiatives for federal and state dam safety officials is the Training Aids for Dam Safety (TADS) program, which consists of 21 modules covering topics from inspection to evaluation to emergency 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.

In FY 2004 and 2005, the Corps completed the updated text for the *Inspection of Embankment Dams* module and the *Evaluation of Seepage Conditions* module. The updates have been prepared in a digital format that can be put on the Internet for easy accessibility. Using TADS funds and their own resources, DOI Reclamation and FERC have been indispensable to the accomplishment of the updates. The Corps also began scanning TADS modules and the ICODS Dam Safety Video

Series for placement on the Corps Learning Network website at <http://usaceln.org/technical>. This effort, which will give these products the broadest distribution, should be completed by the end of FY 2006.

Federal Training Initiative

The primary purpose of the new ICODS Subcommittee on Federal Training Resources is to establish and maintain a collaborative program for federal agency personnel sufficient to meet national dam safety requirements. The Subcommittee will coordinate its activities with the Review Board Training Work Group and the ASDSO Training Subcommittee. The initiatives identified by the Subcommittee for FY 2006 include how to best implement existing cooperative training opportunities, beginning with EAP exercise training; formalizing the process for sharing information on inspections; and the best process (formal and informal) for carrying out the Dam Design and Construction Experience Initiative (D2CEI), a program designed to share engineering expertise across the federal agencies. However, there is still a need for better coordination on dam security matters with the Dam Sector Government Coordinating Council (GCC)/Dam Sector Coordination Council (SCC) and the Risk Management Division (RMD) of the Office of Infrastructure Protection within the DHS Preparedness Directorate.

Information Technology

Information needs for dam safety extend from those in Congress who set national priorities and allocate fiscal resources to those of the dam owner and 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. A primary objective of FEMA in its leadership of the National Dam Safety Program is to identify, develop, and enhance technology-based tools that can help educate the public and assist decision-makers.

National Inventory of Dams

Congress authorized the Corps to inventory dams in the United States with the National Dam Inspection Act (Public Law 92-367) of 1972. The NID was first published in 1975, and has been periodically updated thereafter. The Water Resources Development Act of 1986 (Public Law 99-662) authorized the Corps to maintain and periodically publish an updated NID, and the Water Resources Development Act of 1996 (Public Law 104-303) and the Dam Safety and Security Act of 2002 (Public Law 107-310) re-authorized periodic updates and provided a continued funding mechanism.

The NID is a computerized database of dams in the United States used to track information on our water control

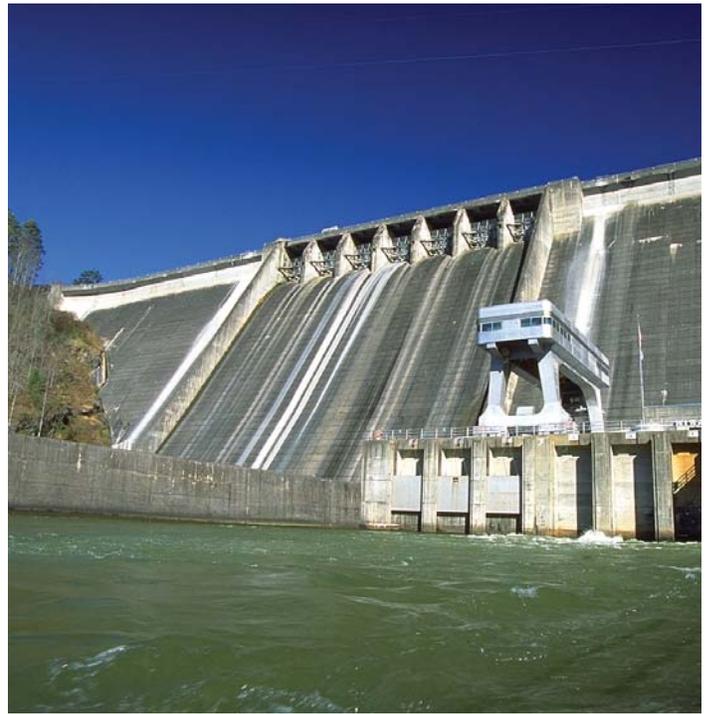
infrastructure, land use management, flood plain management, risk management, and emergency action planning. The NID is maintained and published by the Corps with information from all 50 states, Puerto Rico, and 16 federal agencies. The NID is a dynamic on-line database with scheduled periodic updates and interim updates (as improved data is received from participants). The NID also includes Internet-based tools to query the data, and features a Geographic Interface System (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 data on approximately 79,500 dams throughout the United States that are more than 25 feet high, hold more than 50 acre-feet of water, or are considered a significant hazard if they fail. The NID web site enables query of dams using any of the 42 fields of information, including dam name, height, type, purpose, year of construction, and owner, with query results shown on a screen or available in a downloadable file. Users can also display dams on a map of the United States that includes features such as state, county, congressional boundaries, waterways, and major cities.

The Review Board Work Group on the NID, which is chaired by the Corps, provides guidance and recommendations concerning the data element, format, and publication media for the NID. The Work Group provides a permanent forum for federal and state organizations to advise the Corps, via the Review Board and FEMA, on issues relating to the NID, and to make recommendations on institutional, managerial, technical, policy, and security issues that affect the NID. The Work Group on the NID also oversees activities relating to the publication and use of the NID on the Internet and other communication media.

In response to the terrorist attacks of September 11, 2001, there was an increased focus on infrastructure protection nationwide. Following the attacks, the Corps removed the NID from public access while the open availability of the NID with 44 fields of information was analyzed. The ICODS NID Subcommittee concluded that most of the NID data did not pose significant security risks to the Nation's dams, and was information that could reasonably be obtained by the general public through other means, such as almanacs. As a result, the Subcommittee recommended to the Corps that the NID be restored to public access. The Corps Headquarters Dam Safety Officer concurred, and the NID was restored to public Internet access in August 2002, but with removal of the data fields "Nearest City/Town" and "Distance to Nearest City/Town." The Corps and DHS continue to coordinate NID data security issues with the Dam Sector GCC and the SCC.

In February 2005, the Corps completed its most recent update to the NID. The update captures more accurate and more



Hiwassee Dam, NC.
Photo courtesy Tennessee Valley Authority.

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.

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 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 government and non-government risk management and decision-making at the state, local, and national levels.

Dam Safety Program Management Tools

Since authorization and implementation of the National Dam Safety Program, it has become increasingly clear that there are broad information needs required to support dam safety. These data needs include:

- Documenting the condition of the Nation's dams
- Tracking the existence and progress of dam safety programs

- Supporting dam safety professionals who are responsible for evaluating and maintaining the safety of dams in the United States

Satisfying many of these data needs is the Dam Safety Program Management Tools (DSPMT). The DSPMT is an information collection and management system that is controlled locally by federal and state dam safety program managers and which interacts with national external cooperative information resources for providing as-requested and periodic information on local dam safety information, program needs, and accomplishments within each organization’s jurisdiction.

The purpose of the DSPMT is to provide dam safety program managers with a tool to collect unbiased data about dams and dam safety programs, check selected data for accuracy, and then use the data to achieve an accurate local and national inventory of dams and to help address programmatic questions such as:

- How well are our dam safety programs being implemented?
- Are we doing too much in some areas and not enough in others?
- 24 • Are we spending our scarce resources in the right places?
- Are we improving?

The DSPMT consists of a set of interactive software programs that provide a resource to the dam safety data owners, managers, and data providers. The DSPMT includes three distinct, complementary, and interoperable software programs:

- The Dam Safety Program Performance Measures (DSPPM).
- The National Inventory of Dams (NID) Electronic Submittal Workflow

- Dam Safety Program Reporting Tools to National Oversight Organizations

Dam Safety Program Performance Measures

The performance measures, or indicators, use unbiased data to assess effectiveness of dam safety programs and organizations. Performance measures have been defined and implemented in the following seven key areas:

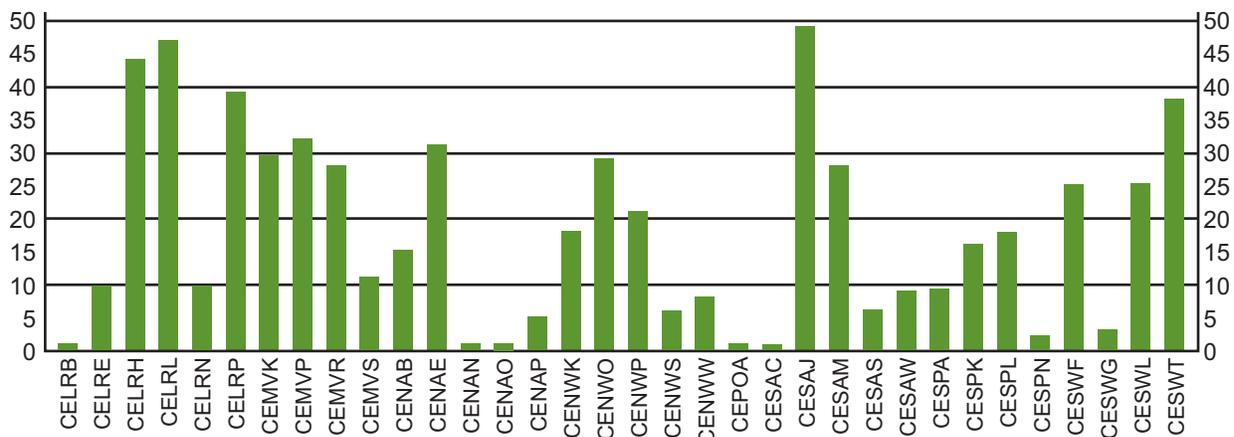
- 1 Dam Safety Program Management Authorities and Practices
- 2 Dam Safety Staff Size and Relevant Experience
- 3 Inspections and Evaluations
- 4 Identification and Remediation of Deficient Dams
- 5 Project Response Preparedness
- 6 Agency and Public Response Preparedness
- 7 Unscheduled Dam Safety Program Actions

These broad performance measures are supported by detailed spreadsheets targeted to individual aspects of the performance measures. The following detailed additional spreadsheets are currently available within the DSPMT:

- Staffing Spreadsheet
- Deficiencies and Budgeting Prioritization Spreadsheet
- Documentation Spreadsheet

Additional spreadsheets are planned for implementation in late FY 2005 including a hydrologic evaluation spreadsheet and a spreadsheet supporting Portfolio Risk Assessment for Screening. Utilization of the full performance measure capabilities by the Corps will be used to temper agency recommendations on budgeting priorities for dam safety deficiencies in the FY 2007 and future budgets. These additional spreadsheets allow histograms of data to be generated that provide insight into the capabilities and challenges faced by the organization.

Figure 6: Number of Dams by Owner



For example, Figure 6 shows the distribution of numbers of dams operated and maintained by each district.

The full database of DSPMT information for Corps districts and divisions was utilized to support and generate the Corps submission for this biennial report

Performance measure output at each level in an organization can be used individually and/or collectively to evaluate the “health and progress” of the program at that level. These same data can then be used at the next higher level to evaluate program performance or program “health and progress” on broader and broader scales, e.g., district, division, agency, state. The performance measures can be used by organizations such as the ASDSO, the Review Board, ICODS, and the FEMA to evaluate the “health and progress” of dam safety programs on national scales. Historical data sets will allow establishment of baselines for each organization or state from which comparisons can be made to measure degree of change or improvement and to generate timelines of data from which trends may be observed.

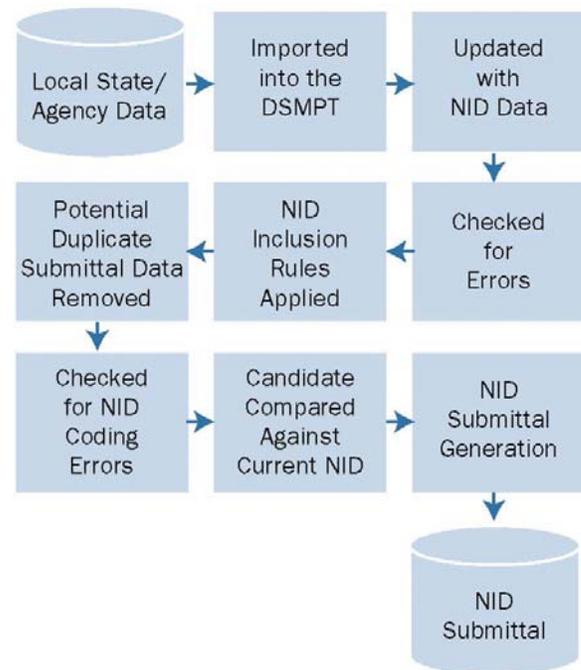
NID Electronic Submittal Workflow

The NID 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 (Figure 7) is graphically represented in the User Interface form shown.

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, are kept in the loop by the program as it highlights areas in the data that potentially need attention, modification, or double-checking. By performing these workflows at the state and agency level, and by using the original data from the day-to-day dam inventory management tools, the data quality and accuracy of the submittal is significantly enhanced. It should be noted that members of the Dam SCC have voiced concerns with the NID obtaining information from the states and federal agencies, rather than going directly to the dam owners.

In FY 2005, the states and federal agencies have again been requested to provide dam inventory data to update the next NID. This data collection effort will build upon the tools and experience gained during the publication of the previous NID. By utilizing and applying the knowledge base gained during the past duplicate resolution effort, this effort should be significantly reduced for generating the next NID. The near-term goal is to be able to publish the NID every 2 years. Although not yet achieved, the long-term goal is to have a “living” NID in which electronic contributions from the states and federal agencies can be incorporated in near real-time to when they were submitted, meaning that whenever changes are made in

Figure 7: NID Electronic Submittal Workflow



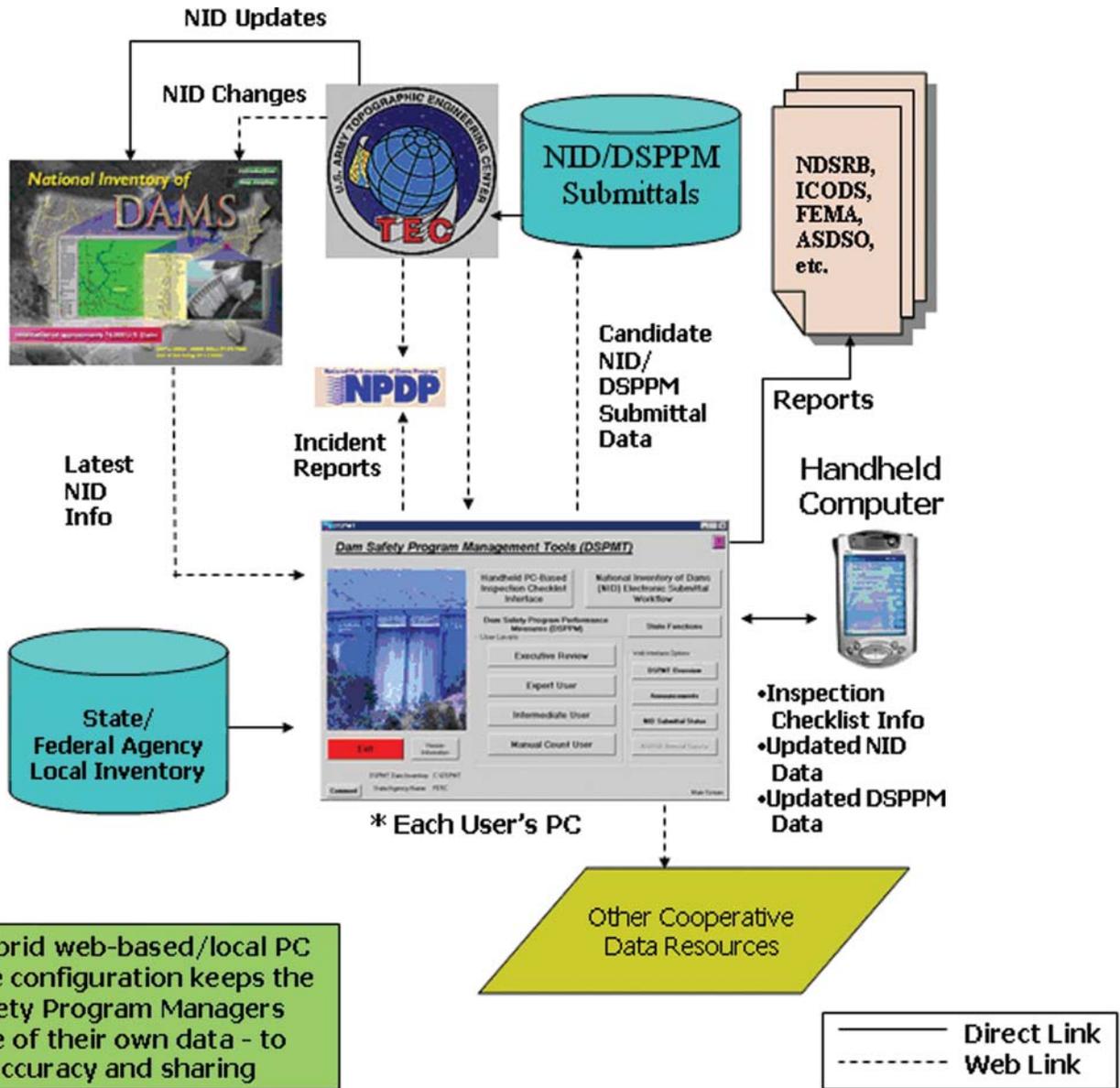
a state or federal agency local inventory, those changes will be reflected in a current, ongoing NID within a few days.

Dam Safety Program Reporting Tools to National Oversight Organizations

Utilization of DSPMT data collection and reporting capabilities provides insight into the contributing organization’s dam safety program, both individually and collectively. Electronic reporting of dam safety program information is used to help determine whether program improvements are occurring and how a program stands relative to the dam safety programs of other organizations. This facilitates the development, documentation, and modification of practices by supporting performance measures which directly address all aspects of an organization’s dam safety program, ranging from legislative authorities, dam safety staff size and relevant experience, inspection program, identification of deficient dams, remediation needs and accomplishments, and emergency action planning and response.

An ongoing concern among national oversight organizations has been how to continue to maintain high levels of state participation in providing requested data in an environment of ever increasing requests for additional data. States are currently being asked for data to support inventory update requests from the NID, State Evaluation Criteria Report data from the Review Board, annual survey data from ASDSO, and annual dam safety program information from the Community Rating System (CRS) in support of the National Flood Insurance Program. These requests for data occur at differing times of the year and vary in terms of their complexity. The goal is to incorporate capabilities into the DSPMT to support a combined reporting workflow so that all of the data requests

Figure 8: DSPMT Information Flow



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can be satisfied with an annual one-time-only electronic data report. In FY 2005, this was accomplished with a combined Review Board/ASDSO manual count user capability. In FY 2006, the combined reporting capability will include the CRS questions. Since the updated inventory used for reporting NID data will be available, it will be utilized to provide recommendations on providing answers, where possible, to the combined dam safety program questions. For example, the NID information can be used to provide data on numbers of dams, numbers of EAP's, and numbers of inspections. This should improve the accuracy and quality of the data being reported to the national oversight organizations.

The use of the DSPMT by federal agencies and the states is illustrated in the information flow overview shown in Figure 8. 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, the ASDSO annual survey, and providing incident information to the National Performance of Dams Program (NPDP).

National Performance of Dams Program

The NPDP, which is headquartered at Stanford University, is a national effort to retrieve, archive, and disseminate information on dams and their performance in the United States. 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, which works with professional associations and federal and state agencies, receives reports on dam incidents, i.e., events that relate to the structural and operational integrity of dams. The NPDP home page address is <http://npdp.stanford.edu/>.



Douglas Dam, TN. Photo courtesy Tennessee Valley Authority.

Federal Agency Programs

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 the Federal Emergency Management Agency (FEMA). Since that initial report in 1980, the Director of FEMA has solicited follow-up progress reports from the agencies at 2-year intervals.

All of the federal agencies responsible for dams continue to implement 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. Below is a description of federal agency activities in FY 2004 and 2005 in some of the areas covered by the *Guidelines*.

Organization, Administration, and Staffing

As in previous reporting periods, challenges face the dam safety community in the United States because of reductions in funds and the corresponding decrease in staffing levels for

dam safety. According to the report from the U.S. Army Corps of Engineers (Corps), several Districts and Divisions lost experienced dam safety engineers and engineering technicians from attrition. Additional attrition and retirements in the next 3 to 5 years will seriously affect the Corps' ability to adequately staff dam safety offices in several locations. To combat the loss of expertise, the Corps has implemented a number of initiatives, including a proactive dam safety program that provides a variety of analysis and rehabilitation design and construction opportunities for its professionals and extensive training and research and development programs. The Corps also is involving younger engineers in dam safety activities and making sure that more experienced engineers are working with them to assure that they are gaining knowledge of the dams in the Corps' inventory.

The Tennessee Valley Authority (TVA) continues to maintain an adequate staff of experienced dam safety engineers in all disciplines. TVA has implemented an engineering graduate progression program to ensure that dam safety engineers develop a broad base of technical capability and expertise. The program is helping to develop the necessary experience for entry-level engineers to become journey-level dam safety engineers.

The Mine Safety and Health Administration (MSHA) reports significant staffing increases in FY 2004 and 2005. The MSHA impoundment safety program involves the 11 districts of Coal Mine Safety and Health, the 6 districts of Metal and Nonmetal Mine Safety and Health, the Mine Waste and Geotechnical Engineering Divisions within the Pittsburgh Safety and Health Technology Center of Technical Support, and the National Mine Health and Safety Academy.

The Mine Waste and Geotechnical Engineering Divisions currently consists of 22 engineers, an increase of 4 engineers since the last biennial report. In Coal Mine Safety and Health, there are now 36 employees in the District offices and 1 employee on the Headquarters' staff, an increase of 17 employees from the last biennial report. Metal and Nonmetal Mine Safety and Health has 12 employees in the District offices that have duties related to impoundments beyond that of a regular mine inspector and 1 employee on the Headquarters' staff responsible for coordination of the impoundment program. This represents an increase of 12 employees from the previous reporting period.

The International Boundary and Water Commission (IBWC) is responsible for implementing the boundary and water treaties between the United States and Mexico and settling differences that may arise out of these treaties. The IBWC is an international body composed of the United States Section and the Mexican Section, each headed by an Engineer-Commissioner appointed by his/her respective president. The United States Section of the IBWC (USIBWC) is headquartered in El Paso, Texas. The USIBWC administers its dam safety program with one Principal Engineer and one Dam Safety Officer located at the IBWC Headquarters and five field office project managers. There have not been any changes in the way the USIBWC administers its dam safety activities since the last report.

The Federal Energy Regulatory Commission (FERC) reports that its technical staff is adequate and competent in hydrology, hydraulics, civil engineering, geology, engineering geology, field investigations and inspections, and geotechnical and structural design. When the need for additional expertise arises, FERC employs qualified outside consultants to provide an independent assessment or to supplement staff expertise. During the past 2 years, staffing in the FERC Dam Safety Program was increased to effectively address workloads and to continue enhancing the FERC program. As of September 30, 2005, there were 120 technical and support personnel assigned to the FERC Dam Safety Program, an increase of 5 personnel since the last reporting period.

The Department of the Interior (DOI) Bureau of Land Management (BLM) was required to provide responses to approximately 35 items requested for this progress report and to compare the results of specific items to identical items in the FY 2002 and 2003 progress report. For the adequacy of

state dam safety organization and staff category, 46 percent of respondents noted adequacy in this area. Alternately, 54 percent of the respondents expressed concern about their staffing levels, stating that additional full-time equivalents (FTE's) are needed. The DOI's BLM reported an increase of 8.2 percent in FTE's performing dam safety activities from the last reporting period, from 80 FTE to 87 FTE. Although the number of FTE's shows an overall increase, there are four states and the Washington Office that require additional FTE's to perform all dam safety work. The DOI BLM also reported a 10.5 percent increase in the number of hours spent on dam safety activities in the current cycle compared to the FY 2002 and 2003 period.

The DOI's Bureau of Reclamation (Reclamation) reports that it has excellent management and technical staff resources to accomplish its dam safety activities in accordance with the Guidelines. The maintenance of technical expertise continues to receive the attention of DOI Reclamation's leadership. The DOI Reclamation has implemented a workforce capability planning process that uses a strategic planning approach to match staff resources with future program needs. DOI Reclamation staff decreased from 6,700 employees in June 2003 to 5,900 employees in May 2005.

The U.S. Forest Service (FS) reports that there is adequate staffing for most of its current requirements. For its Intermountain Region, FS reports that all dam-related engineering work on the National Forests is performed as an auxiliary duty (the Intermountain Region involves the administration of FS-owned and special use permitted dams on 19 National Forests in Utah, Nevada, southern Idaho, western Wyoming, a portion of the Sierra Nevada in California, and a small area of western Colorado). The FS notes that dam-related activity has been strong on forests with experienced engineers who have been managing the dams for many years. These forests, however, will suffer in the immediate future as at least two engineers are planning to retire on forests that have the highest dam workload in the region. The sharing of dam engineering skills across forests and/or regions will present many challenges to effectively administer the FS dam safety program.

The Natural Resources Conservation Service (NRCS) reports its dam engineering expertise and staffing levels have generally declined over the past decades as overall federal dam design and construction activity has decreased. NRCS installed more than 1,200 new National Inventory of Dams (NID)-size dams in 1965 but less than 200 in 1990, and probably less than 100 in 2000. The number of engineers and engineering technicians in NRCS has declined over most of the past decade, but has increased over the past several years to address new agency programs and authorities, including watershed dam rehabilitation. NRCS established a National Design, Construction and Soil Mechanics Center in 2000, and this staff has become a significant internal source of dam

expertise. Since the last reporting period, NRCS reports an increase of approximately 45 engineers (Series 810 and 890).

NRCS has a Memorandum of Understanding (MOU) with DOI Reclamation to collaborate and share technology and resources on water resource activities. NRCS and the Corps also signed a Partnering Agreement in July 2005 that contains a section on watershed planning and implementation, including “technology, services, and data exchange to assure safety of existing and new dams.” The Agreement provides liaison positions and teams to coordinate program and technical resources. These partnerships and other initiatives should significantly supplement NRCS technical capacity to work on dams in the coming years.

Dam Inventories

The Corps reports that no significant downstream land use changes were made to its inventory of dams in this reporting period. However, the Mississippi Valley Division reported that the hazard classifications for some of the locks and dams were changed from high- to significant-hazard potential since the last report. The South Pacific Division reports that there have been notable developments within spillway discharge channels on numerous flood projects that were designed and constructed by the Corps and turned over to local sponsors for operation and maintenance.

Since the last report, the number of dams in the MSHA Coal Mine Safety and Health districts increased by 24 while the number of dams in Metal and Nonmetal Mine Safety and Health districts remained constant.

The Nuclear Regulatory Commission (NRC) reports that no new dams have come under its regulatory jurisdiction during this reporting period. However, two embankment dams associated with the Ambrosia Lake mill site that were added to the inventory in the last reporting period are being removed by the end of this reporting period. Another dam at the White Mesa mill site in Utah was transferred to the State of Utah when Utah became an NRC Agreement State for uranium recovery sites.

In FY 2004 and 2005, there were 22 hazard classifications performed within the DOI’s Bureau of Indian Affairs (BIA) Safety of Dams Program. The DOI BIA has approximately one-fourth of all high- or significant-hazard potential dams within the DOI.

Two years ago, DOI BLM reported that it had 534 hazard-classified dams and 338 private/permitted dams on DOI BLM-administered lands. In some instances, several dams thought to be on DOI BLM public lands property were confirmed to be on other property. For this cycle, DOI BLM

is reporting 515 hazard-classified dams and 301 private/permitted dams.

The DOI’s Reclamation inventory of dams has changed during the reporting period. DOI Reclamation currently has 479 dams and dikes. Of these, 361 would endanger people if they failed, and are rated as high- or significant-hazard potential structures. Facility inventory changes in the reporting period included the removal of four facilities. Sugar Pine Dam and Sly Park Dam and Saddle Dike in California were transferred to local districts. Elwha and Glines Dams in Washington were removed from DOI Reclamation’s inventory (the DOI National Park Service (NPS) is responsible for these two facilities). In addition, eight dams were added to DOI Reclamation’s inventory in FY 2005. Hazard classification studies are currently being performed for the structures and will be added to the DOI Reclamation inventory.

The DOI NPS reports that some dams, both DOI NPS and non-DOI NPS, are having both their downstream and public safety hazard potential classifications increased because of greater visitor/employee activity downstream and around dams and impoundments. For example, at Cumberland Gap National Historical Park, Kentucky, an intermediate size, downstream high-hazard potential classified dam is being considered for acquisition for watershed protection and has been updated in the DOI NPS inventory of dams. The proposed project is Fern Lake Dam.

The DOI United States Geological Survey (USGS) reports only one DOI USGS dam. However, the DOI USGS has acquired additional properties in recent years. A canvas of these properties is underway to determine if other dams may be on DOI USGS properties.

According to the FS, the accuracy and completeness of information in its database of dams is a concern. Maintaining data for an inventory of 2,000 dams is a major challenge for field personnel, especially during times of reduced budgets. In FY 2004 and 2005, the emphasis has been on updating and completing the required NID data fields for FS-owned high- and significant-hazard potential dams. For permitted dams and dams under the jurisdiction of other federal agencies located on National Forest Lands, only the minimum data necessary for awareness of a dam’s physical condition and downstream impact will be maintained in the FS inventory. The FS will work closely with state and federal agencies to ensure that all NID dams located on National Forest Lands are inventoried by the appropriate agencies.

NRCS populated a dam inventory database that tracked over 120 fields of data on a central mainframe computer in the late 1970’s. NRCS restructured its database in 1993 and again in 1998 to comply with the data structure for the NID. In January 2002, NRCS submitted available data on 24,995

NRCS-assisted, NID-size dams to the Corps for inclusion in the NID. A nationwide update of data in the NRCS inventory was completed in 2004. Several NRCS states report working closely with state dam safety agency counterparts to rectify data discrepancies between NRCS and state datasets. All current data on NRCS-assisted, NID-size dams will be submitted to the Corps for the NID 2006 data call.

An ongoing NRCS effort was begun in 2000 to update the hazard potential classification of all NRCS-assisted project dams over 5 years. As part of this effort, Oklahoma NRCS has inspected, digitally photographed, and located by global positioning system (GPS) more than 2,000 of their project dams over the past few years. Similar ongoing efforts in other NRCS states will significantly improve dam inventory data, particularly for project dams.

Inspection Programs

A number of Corps districts are exchanging engineers for the periodic inspection of major projects to provide additional training for the engineers while obtaining a fresh look at the dam. Although there are no major staffing inadequacies that threaten the inspection program, the Corps again reports that it is increasingly difficult to properly staff inspections with experienced dam safety personnel, especially at smaller districts. In these cases, resource sharing among districts is available to help minimize the challenges. In addition, a number of young engineers are included on the inspection teams for training purposes.

The Department of the Army (Army) reports that 88 dams were inspected out of an inventory of 212 dams in FY 2004 and 2005. The Army notes that the most important issue related to inspections is obtaining the funding to conduct the inspections, and that most inspection results indicate that the dams do not meet current criteria and will need additional work to meet current criteria. Other problems associated with inspections include staffing (quality, experience, training, and the number of inspectors) and critical findings of the inspection (unsafe dams and conditions and improper classifications).

The Department of Energy (DOE) agreement with FERC provides for periodic inspections by FERC of all dams and other water impoundment structures. FERC inspections are performed annually on dams that have been hydrologically defined as having a high- or significant-hazard potential classification, and every other year on dams with a hydrologically defined low-hazard potential classification.

TVA conducted 582 dam safety inspections in FY 2004 and 2005. The number of inspections is lower than in the previous reporting period because of the combination of

mechanical and electrical inspection descriptions. There was no reduction in the scope of detailed inspections. TVA uses trained, in-house mechanical, electrical, and civil engineering staff to conduct both scheduled and special dam safety inspections.

MSHA inspects structures associated with underground and surface coal mines at least four times and two times each year, respectively. As staffing permits, facilities are inspected on a monthly basis during critical periods of construction. MSHA also is in the process of updating its Impoundment Inspection Handbook, which provides guidance to Coal Mine Safety and Health Inspectors on the proper inspection techniques for dams. MSHA also inspects structures associated with underground and surface metal and non-metal mines at least four times and two times each year, respectively.

Using Technical Advisors from the Corps, the IBWC conducted 5-year inspections of Amistad, Falcon, Anzalduas, and Retamal dams in 2003. International Dam is scheduled to be inspected by the U.S. Section and Mexican Section staff in 2008. In addition, the IBWC conducts weekly inspections and prepares monthly reports for Amistad and Falcon dams. Monthly inspections and reports are prepared for Anzalduas and Retamal dams.

Between October 1, 2003, and September 30, 2005, FERC staff independently reviewed the safety and adequacy of 352 dams. During the reporting period, staff completed 5,191 engineering evaluations, investigations, and studies, with 533 in progress at the end of the period. Construction plans and specifications also were reviewed by staff for all licensed projects. FERC conducted 263 construction inspections between October 1, 2003 and September 30, 2005. FERC staff also conducted 348 inspections of dams where specific problems occurred that related to design changes required by unanticipated field conditions encountered during construction; poor maintenance that caused concern for project safety or environmental noncompliance; and special remedial actions necessary to ensure the continued structural integrity of a project and compliance with license requirements and exemption conditions. These inspections are considered special inspections, as defined by the *Guidelines*.

The NRC continues to use the technical assistance of FERC to assist with dam safety inspections at NRC licensee facilities. During this reporting period, FERC personnel, accompanied by NRC staff, completed inspections at nine licensee facilities (seven nuclear-powered electric generating facilities and two uranium process sites).

DOI NPS personnel typically perform annual, informal inspections for routine maintenance and repairs. DOI Reclamation, the Corps, or NRCS, with state personnel, are used for more formal dam safety examination and analyses

for larger, more complicated projects. There are currently 173 DOI NPS dams with serious maintenance, operational, structural, or public safety type deficiencies. Of these structures, 23 are classified as high- or significant-hazard potential. The structures are being corrected at a steady rate and as budgets permit.

At the request of DOI USGS, DOI Reclamation reviewed the EROS dam (the only DOI USGS dam) in April 2003. The inspection led to a number of recommendations, including the completion of a formal Downstream Hazard Classification Report. The report was completed by DOI Reclamation in November 2003 and resulted in the classification of the EROS dam as a high-hazard potential facility. The report also recommended that DOI USGS prepare an Emergency Action Plan (EAP) for the dam. The EAP will be completed in FY 2006.

In general, findings from inspections on FS dams indicate that routine maintenance is very limited and continues to be deferred because of a lack of funding, priority, and available trained personnel.

NRCS policy is to encourage state agencies to assume responsibility for routine inspection of existing NRCS-assisted dams. NRCS provides technical assistance for routine inspections as resources permit and as requested by the dam owner. NRCS-assisted dams are inspected by hundreds of different organizations, ranging from state agencies conducting formal inspections, local project sponsors conducting intermediate inspections, or walkover Operational & Maintenance (O&M) inspections by non-engineers.

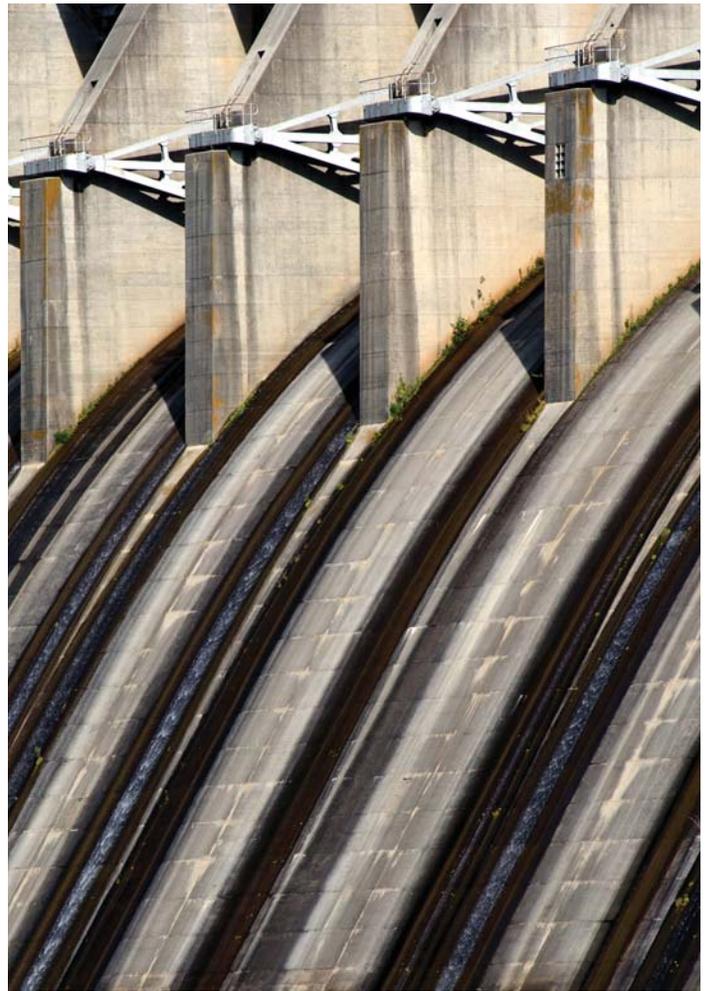
Dam Safety Rehabilitation Programs

The DOE upgraded one dam (Pond B Dam at the Savannah River Site) to correct seepage through the dam and approved design plans for an upgrade to dam C-2 outlet at Rocky Flats.

Between October 1, 2003 and September 20, 2005, FERC completed 47 dam safety modifications. In addition, 77 dam safety modification are ongoing or under review by FERC.

MSHA does not maintain data on the cost of repairs because the dams within its jurisdiction are privately, rather than publicly, owned. All responsibility for the cost of repairs rests with the mining companies.

The FS reports that dam rehabilitation projects compete with other facility improvements. Needs are addressed on a worst case basis and attention to dam rehabilitation needs vary by



J. Strom Thurmond Dam, SC. Photo courtesy U.S. Army Corps of Engineers.

forest. Dam rehabilitation projects are often proposed years before they are actually funded and completed.

For project dams, the NRCS was authorized under the Small Watershed Amendments of 2000 to provide technical and financial assistance for rehabilitation, which is defined in the statute as “all the work necessary to extend the service life of the structural measure (dam) and meet applicable safety and performance standards.” NRCS estimates the overall project dam rehabilitation needs as roughly \$550 million. Most of the initial implementation effort has been to communicate this new authority to eligible dam owners, receive and process applications for assistance, rank applications with a risk-based profiling system, assess individual dam rehabilitation needs, develop watershed work plans, and begin the design process. NRCS was appropriated \$29.6 million in 2004 and \$27.5 million in 2005 for this program. More than two dozen projects have gone to construction during the reporting period and many additional projects are in the planning or design phase or are waiting for funding. Several hundred new applications from local dam owners are pending.

Management Effectiveness Reviews

In its last report, MSHA stated that an internal review of the impoundment safety program had just been completed. Activities undertaken to improve the impoundment safety program during this reporting period include a steady decrease in the backlog of plans waiting for review and a decrease in turnaround time for plans; clarification of MSHA's dam safety structure; revision of the Impoundment Inspection Handbook; and the conduct of field demonstration projects to validate the applicability of various geophysical methods to locate underground mine workings that may not be shown on maps.

During this reporting period, the FERC Division of Dam Safety and Inspections (D2SI) conducted a Summary Management Review, as mandated by the Federal Managers' Financial Integrity Act. On September 30, 2003, an Assurance Memorandum was forwarded to the Chairman, FERC, through the Director, Office of Energy Projects, attesting that the D2SI was able to meet their management goals and objectives, there were no obstacles or funding shortfalls impacting the ability to accomplish its mission, and there were no reportable problems requiring the attention of higher management. During this period, there were no receipts of Government Accounting Office (GAO) and/or Inspector General Reports concerning the Division.

The DOI BLM implemented a self-assessment on permitted dams that are located on DOI BLM lands. The self-assessment includes about 70 questions to assess detailed information on regulatory involvement, inventories, condition assessments, EAP's, and other related topics. The draft report was completed in FY 2005. The DOI BLM also initiated a Service First Initiative in FY 2005 to primarily address private/permitted dam issues. Partner organizations include the DOI NPS and the FS.

The DOI Reclamation's Dam Safety Officer provides an ongoing review of dam safety activities and an annual Program Evaluation Report to the Commissioner that includes recommendations based on the findings of the Dam Safety Officer and those of an Independent Review Panel. In this reporting period, DOI Reclamation also requested that the National Research Council assist it in determining the appropriate organizational, management, and resources configurations to meet its construction mission and related infrastructure management responsibilities for the 21st century.

Although the GAO did not conduct any management reviews at Corps facilities, internal program review by the Dam Safety Committee occurred at headquarters, division, and district levels. During this reporting period, the Corps Dam Safety Community of Practice Steering Committee published a draft

update to the dam safety regulation for interim use. This revision of the regulation implemented a number of Peer Review recommendations.

Dam Safety Training Activities

The Corps continues to offer an extensive program for training personnel in all matters related to its water resources mission. Much of the training is directly or indirectly related to dam safety. The training program, for engineers and dam operation and maintenance personnel, consists of seminars and conferences, formal classroom training, and periodic on-site training. Site training is designed to acquaint project personnel with basic engineering considerations relating to major structures, including site-specific considerations, with procedures for surveillance, monitoring, reporting of potential problems, and emergency operations. Operations and maintenance personnel are retrained periodically, at a maximum interval of 4 years. New Project personnel are immediately scheduled for dam safety training. The 2005 Tri-Service Infrastructure Systems Conference included 3 full days of dam safety specific presentations and many additional presentations related to the structural, mechanical, and electrical elements of dams.

DOE supports dam safety training by offering its field organizations reports and videotapes developed by the Interagency Committee on Dam Safety (ICODS). DOE personnel and DOE contractor personnel also attend the National Dam Safety Program Technical Seminars.

The main thrust of TVA's training continues to be on-the-job training under the supervision of experienced engineers and inspectors. TVA also conducts Dam Safety Awareness and Emergency Preparedness training programs that are required curriculum (including both classroom and hands-on instruction) for staff in all TVA organizations involved in a dam safety event or who may work or visit a dam site. Technically qualified TVA project personnel are trained in inspection procedures, problem detection, evaluation, and appropriate remedial (emergency and non-emergency) measures.

Since 1982, MSHA has had an ongoing program of annual training seminars for its District impoundment specialists. At these seminars, MSHA engineers and speakers review information on dam design and inspection and provide updates on new dam safety developments and products. MSHA also provides continued professional development and training opportunities for engineers in the Mine Waste and Geotechnical Engineering Division of Technical Support and other personnel involved with impoundment safety. Newly hired Mine Inspectors attend a training program at the Mine Health and Safety Academy that covers all aspects of a mine inspector's job, including dam inspections.

To allocate training funds efficiently and effectively, FERC has concluded that training would be more effective if courses were developed to specifically satisfy its needs. The proper mix of training is emphasized for the development of staff. FERC gave two training workshops in FY 2004 and one training workshop in FY 2005 to train FERC staff, dam owners, and consultants on the Dam Safety Performance Monitoring Program (DSPMP). FERC also conducted one workshop to solicit comments and suggestions on ways to improve the DSPMP. The comments were incorporated in the July 1, 2005 revision of Chapter 14 of the Engineering Guidelines. FERC staff also developed and conducted multi-day emergency preparedness and security workshops for licensees and other dam safety and security specialists in San Francisco in 2004 and Fort Worth in 2005. In addition to these workshops, FERC staff provided vulnerability assessment methodology outreach to licensees as part of the EAP Exercise Design Course in 2004 and 2005.

Historically, the DOI FWS Dam Safety Officer has provided training to refuge and hatchery staff, dam tenders, and regional Dam Safety Officers and representatives. As a result of a previous DOI Peer Review recommendation, the DOI FWS Dam Safety Officer initiated a service-wide dam safety training program. The objective was to provide dam safety training at all field stations where high- and significant-hazard potential dams are located. The DOI FWS completed this training and the DOI FWS Dam Safety Officer plans to repeat the cycle of training in FY 2006.

The DOI Reclamation continues to perform, support, and participate in a variety of dam-safety related training activities. DOI Reclamation actively participates in professional societies such as the Association of State Dam Safety Officials (ASDSO), the United States Society on Dams (USSD), and the American Society of Civil Engineers (ASCE). The DOI held annual DOI Dam Safety Coordinators Meetings in May 2004 and April 2005. Representatives from the DOI Bureaus, various Tribes, the Corps, and ASDSO attended both meetings. DOI Reclamation also sponsored week-long seminars on the Safety Evaluation of Existing Dams (SEED) in May 2004 and 2005. Although the seminars are based on DOI Reclamation's SEED program, many other state and federal agencies participate in the seminar. DOI Reclamation also continues to administer the Training Aids for Dam Safety (TADS) program.

To ensure that the lessons learned from the Teton Dam disaster are not forgotten, DOI Reclamation is currently producing videos for use by both managers and staff. The videos will highlight changes that have been made to respond to the conditions in place at the time of the Teton Dam failure and the importance of continued vigilance in assuring attention to dam safety.

FS personnel involved in dam safety and management activities are encouraged to participate in dam-related training sessions and meetings. However, reduced travel budgets and training funds may limit the ability of staff to update and reinforce required skills. In FY 2004 and 2005, FS held two National Dams Engineer Meetings. In FY 2005, the Pacific Southwest Region Office sponsored a dam safety training session for FS engineers. The FS Intermountain Region also maintains an active dam certification program that is offered every 2 to 3 years.

NRCS engineers participated in many national, regional, and local training sessions, workshops, and conferences that provided technology related to dam safety. Participation has increased significantly over the past few years. NRCS staff also cooperated with state dam safety agencies and other organizations to conduct joint training seminars and workshops. For example, Georgia NRCS collaborated with state dam safety to conduct a 2-day training session for local engineering firms on NRCS technology and criteria, state dam safety rules and regulations, and the developing rehabilitation workload.

Dam Failures and Remedial Actions

33

The Army reports that Overhills No. 2, a low-hazard potential dam at Fort Bragg, North Carolina, was breached during a rain event around August 30, 2004. The dam was temporarily repaired and the incident was reported to the National Performance of Dams Program (NPDP). The Army reports that there is no life safety hazard associated with Overhills No. 2.

MSHA reports nine incidents involving impoundments and tailings structures on mining property. Once MSHA becomes aware of an incident, an investigation is conducted to identify hazardous conditions, determine the probable cause of the occurrence, and ensure that appropriate steps are taken by the mine operator to resolve the issues. The mining company is responsible for investigating the problem, engaging consulting engineers, if needed, and implementing corrective measures, subject to MSHA concurrence. MSHA reports that none of the incidents resulted in injuries. Property damage from the incidents was minimal.

Since October 2003, FERC reports that there have been 36 incidents at dams under its jurisdiction. All but one of the incidents was minor and resulted primarily from operational failures of project facilities such as penstocks or gates. The only significant incident was at the Swinging Bridge Project. The incident required a reservoir drawdown and the implementation of the EAP. Temporary evacuation occurred and there were no consequences other than the reservoir drawdown. Investigations are underway and remedial measures are being designed.



All 10 clamshell valves were opened at Arrowrock Dam in preparation for the dedication celebrating the \$18 million project that replaced the original Ensign valves with the hydraulic-powered, stainless steel valves weighing up to 20 tons apiece.

Photo courtesy U.S. Department of the Interior, Bureau of Reclamation.

The DOI BIA had 14 incidents at its dams during the reporting period, including 5 flooding events, 5 seepage related events, 2 findings of significant deterioration of outlet works conduits, and 2 findings of significant deterioration of an embankment.

The DOI BLM reports one dam failure of Gutshot Detention Dam, a low-hazard potential dam in Montana. The failure was caused by piping through the embankment during a heavy runoff period. The DOI BLM State Engineer is examining options with field personnel, e.g., repair, replace, demolish. A final decision has not yet been made.

No dam failures occurred at DOI Reclamation dams in FY 2004 and 2005. Significant dam incidents occurred at Deer Flat Dam in Idaho (cracks in the walls and floor of the outlet works conduct and sediment in the conduit and canal); Enders Dam in Nebraska (sinkhole discovered); Fish Lake Dam in Oregon (sinkhole discovered); and Hyrum Dam in Utah (voids detected under the spillway floor). DOI Reclamation has taken remedial action in response to the incidents or is monitoring the conditions until long-term solutions are implemented.

The FS Intermountain Region reports that the Enterprise Dam, a special use dam on the Dixie National Forest, experienced a serious storm-related incident in February 2005. The flood overtopped the concrete masonry structure and washed out the road and bridges below. The dam suffered minor damage and was closely monitored for several weeks. Dam repair and/or replacement decisions are being negotiated with the state and the dam owner.

Emergency Action Planning

FERC's EAP training program is nationally recognized and highly acclaimed. The National Dam Safety Program has identified FERC as the national expert and recognizes its role in guiding a national program on Emergency Action Planning and implementation.

FERC developed the current state-of-the-art EAP technology, which is used as a model worldwide. The FERC EAP Program was the first to be fully developed for dam owners. Through this EAP Program, other federal and state agencies are strengthening their programs and ultimately improving EAP's nationwide. Assistance to local emergency response agencies through improved EAP's and inter-office cooperation also is occurring.

FERC held one EAP training course in FY 2004 and two training courses in FY 2005. FERC continues to aggressively pursue the higher level EAP exercise (tabletop and functional) to incorporate local and state disaster preparedness agencies. Under the FERC EAP exercise program, each licensee and exemptee conducts at least one tabletop and functional exercise of an EAP per river basin during a 5-year period. The 5-year cycle is repeated in each basin with a different dam and EAP selected for a functional exercise. This program will continue to maintain the state of readiness of the local and state officials through the cooperation and assistance of the dam owners. In this manner, changes in personnel or improvements to the EAP can be identified and will ensure that the EAP will be kept up-to-date.

FERC has recently 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, representatives 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 its EAP training courses. The exchange of information among these agencies and licensees has resulted in an improved understanding of the needs of each participant and their roles and responsibilities during an emergency. This also allows the participants to meet face-to-face, and provides local agencies with a better understanding of the technical aspects of the EAP, such as the inundation maps. For example, local road names can be added to the maps and evacuation routes normally used, which would become inundated in an emergency, can be highlighted so that alternate routes can be chosen and the range of possible flooding can be addressed thoroughly. These efforts greatly improve the likelihood of saving lives in the event of an emergency.

FERC recently initiated an effort to encourage licensees to develop EAP exercises that also include active participation by

upstream and downstream dam owners. Both FERC regulated dams and non-FERC regulated dams are included. This widened approach for coordination optimizes the time and effort required by the local response agencies. It also encourages many non-FERC regulated dam owners to participate in an EAP exercise for the first time and provides opportunities for state dam safety officials to participate and test dams under state regulation. This effort includes coordination with NEMA, the Association of State Floodplain Managers (ASFPM), state Emergency Management Agencies (EMA's), the NWS, and others. To further this cooperative spirit, FERC encourages dam owners to coordinate with and include the NWS in their EAP's. By working together, dam owners and the NWS can exchange valuable information during flood events. This information exchange provides valuable data to the NWS for use in their flood forecasting models. Dam owners also benefit from this partnership by utilizing the capabilities of the NWS to broadcast flood warnings downstream of their dams.

The Corps reports that the number of Flood Emergency Action Plans (FEAP's) increased from 460 to 480 during this reporting period. However, because of the reclassification of some dams from low-hazard potential to significant-hazard potential, an additional 20 FEAP's are required. Districts are budgeting to complete these plans within the next 2 years. In this reporting period, dam safety emergency exercises were conducted at a number of Corps dams to test FEAP's. The exercises simulated a dam failure or a condition that could lead to a failure if appropriate actions were not taken. The Buffalo District of the Corps conducted a functional exercise in FY 2005 that involved the simulated failure of the dam along the gorge and the cutoff wall. Multiple district elements, external agencies, and municipal entities were engaged in the response, which effectively tested the draft EAP. In addition, EAP's were tested at a number of other Corps dams by actual extreme flood events. Several smaller scale emergency exercises were held with other agencies and state and local governments.

The Army reports that plans are being made to assess the age and adequacy of existing EAP's. The Army has 2 high-hazard potential dams and 12 significant-hazard dams that do not meet EAP guidelines. The Army is scheduling EAP updates for high- and significant-hazard potential dams and anticipates that EAP's will be implemented and/or updated for all required dams over the next 5 years.

TVA reports that EAP's have been developed and maintained for all of its dams. TVA regularly conducts EAP exercises for test and training purposes. In FY 2004 and 2005, TVA conducted one internal functional exercise for Ft. Loudoun Dam; participated in one agency-level exercise held in conjunction with an exercise conducted by the Alabama Department of Homeland Security for Wilson Dam;

conducted one formal tabletop exercise for Fontana Dam; conducted numerous tabletop exercises involving dam safety emergency scenarios for River Operations managers; and conducted numerous notification drills using an automated telephone notification system.

The USIBWC has an EAP for each of its large storage dams (Amistad and Falcon), as well as for Anzalduas and Retamal International Diversion Dams. In FY 2004, 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 civil and political authorities from the United States and Mexico. Because of internal training requirements, participation was restricted to IBWC, U.S. and Mexico, and the NWS. Flood Emergency Workshops also are held annually with participation of both Sections of the IBWC and the NWS for Amistad, Falcon, and the Lower Rio Grande Flood Control Project.

The DOI BIA has 64 dams with EAP's; however, many of these documents require revisions to meet current guidelines for EAP's. DOI BIA also reports that the number of dams requiring EAP's is increasing as dams are reclassified from a low-hazard potential to high-hazard or significant-hazard potential classification. Early Warning Systems are in place for 60 DOI BIA dams.

The DOI FWS has made significant format changes to the EAP and Standard Operating Procedures (SOP) documents. All high- and significant-hazard potential DOI FWS dams have updated EAP's and SOP's in the new format and the EAP's and SOP's have been updated according to the latest guidance from DOI Reclamation, FEMA, and ICODS. The DOI FWS continues to implement an annual testing program for EAP's that consists of a simplified test to determine if the EAP is available and up-to-date and that the communications network is current. Exercises on high- and significant-hazard potential dams are conducted every 5 years. In FY 2004 and 2005, the DOI FWS conducted 11 exercises.

The DOI Reclamation reports that all of its high- and significant-hazard potential facilities have EAP's. The EAP's are annually updated and exercised every 3 years, according to DOI Reclamation's directives. State and local government officials, emergency management personnel, and law enforcement agencies are encouraged to participate. In this reporting period, DOI Reclamation continued to strengthen its Emergency Management Program.

The NRCS has no authority to require the development of EAP's on existing dams, but does have current policy to require development of plans before construction is initiated on new or rehabilitated dams. More EAP's are implemented by owners of NRCS-assisted dams every year; however, recent dam inventory data still shows that over 1,000 NRCS-assisted

high-hazard potential dams do not have EAP's. NRCS has an agreement with ASDSO to collaboratively develop a sample EAP for small embankment dams. ASDSO organized a workshop with experts from NRCS, other federal agencies, and several states to compare and contrast their recent EAP efforts. After extensive discussion, a draft was developed by ASDSO. NRCS intends to finalize the draft and incorporate it into an amended National Operation and Maintenance Manual. NRCS also assists dam owners to develop EAP's. For example, Oklahoma NRCS reported assisting dam owners to develop 14 new and 43 updated EAP's. Arkansas NRCS reported 14 new and 2 updated EAP's.

The FS reports that although it is standard practice to have EAP's on all high- and significant-hazard potential dams, many EAP's are in need of review and update, and few are tested on a routine basis. Updating EAP's on FS-owned and permitted dams will be an emphasis of its dam safety program.

Research and Development and Special Initiatives

36 Two Corps research studies focus directly on dam safety: the Risk Analysis for Dam Safety Research Program and the Civil Works Critical Infrastructure Security 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 protect human life, reduce property damage, and mitigate environmental damage; (4) minimize the disruptions of services; and (5) maximize the effectiveness of infrastructure investments.

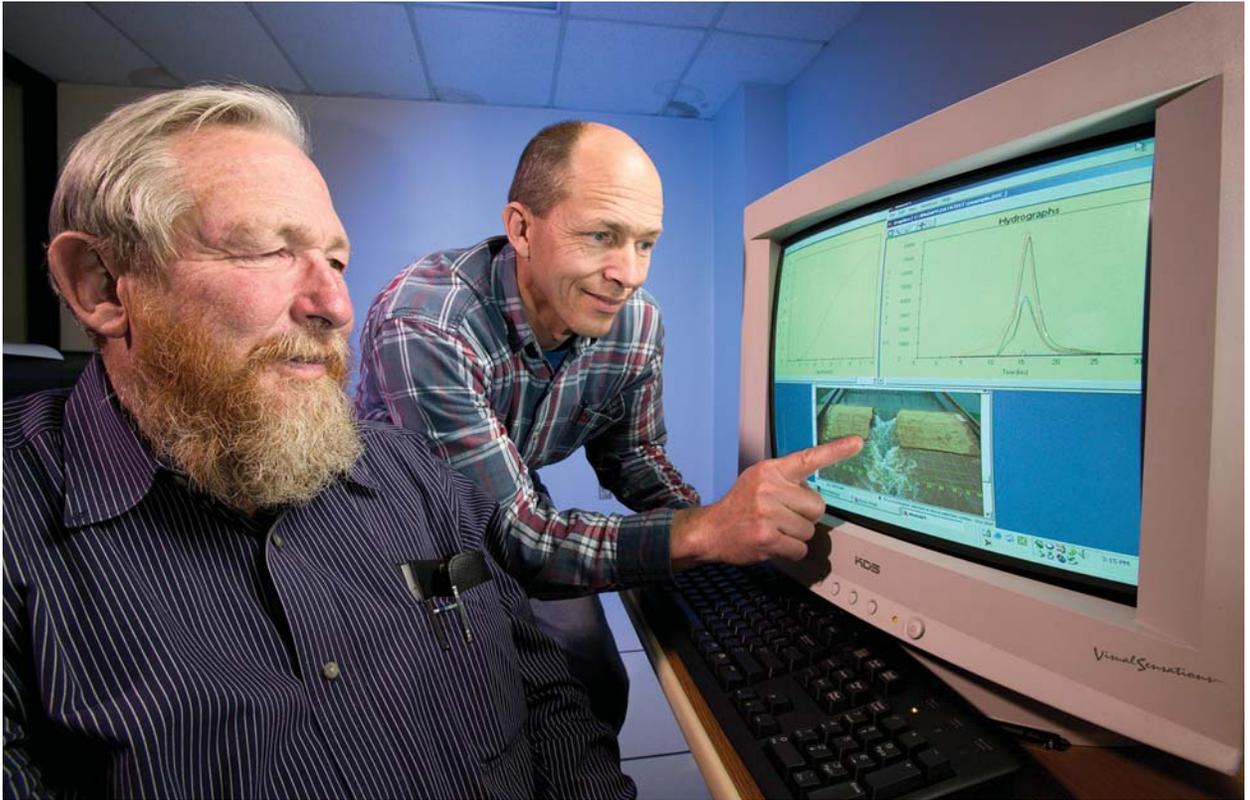
The Civil Works Critical Infrastructure Security Research Program (CWCISRP) is in a state of transition from supporting Baseline Security Posture (BSP) security upgrades to supporting a critical infrastructure all-hazards resilience posture. In support of this transition, current R&D initiatives include a comprehensive study of existing risk assessment methodologies that will lead Critical Infrastructure Security Program (CISP) in the selection of applicable tools and processes to build a nationwide common procedure for post-BSP upgrades consistent with DHS cross-sector initiatives and Corps O&M asset management. In addition, CISP has initiated an effort to assess the amount of risk reduction achieved with the completion of BSP upgrades at a representative sample of critical projects. Future R&D initiatives will include blast mitigation, waterside threat vulnerability and consequences, and the initiation of a testing/exercise program at selected projects.

The 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 and maintenance of the NID and in coordinating the development of the Dam Safety Program Management Tools (DSPMT) software, both of which are described above.

TVA has completed a project to update the EAP flood inundation maps for its dams. The project included the conversion of existing flood boundaries to an Arcview-based GIS system. The updated maps are more useable for emergency planning, response, and evacuation. They were distributed to plan holders with the annual EAP update in late 2004 and are being provided to local and state emergency management agencies. TVA also has completed an update of the seismic hazard maps for the TVA region. The maps and associated uniform hazard curves are being used for ongoing safety assessments and periodic design reviews.

As a result of incidents where mining operations have accidentally cut into unmapped or inaccurately mapped underground workings, Congress appropriated funds to MSHA for digitizing mine maps and for funding projects to develop and demonstrate technology for the detection of underground mine voids. MSHA provided funds to geophysical projects and to the mine mapping project to improve the safety of impoundments in areas that are undermined. Work initiated during the previous reporting period on the use of geophysical methods to detect mine voids has continued. Demonstration projects are now underway and should be completed within the next year. Preliminary findings have been conveyed to industry. MSHA is closely monitoring the progress of the work and is planning to widely disseminate the results to address the serious problems associated with mining under or adjacent to impoundments.

The DOI Reclamation, which serves as the Chair of the National Dam Safety Review Board Work Group on Dam Safety Research, 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 DOI Reclamation further develops and refines risk analysis approaches. DOI Reclamation also is collaborating with the Corps on risk analysis. In FY 2004 and 2005, DOI Reclamation implemented several procedures to improve and standardize risk-based decision making techniques. DOI Reclamation standardized a graph to visually display and to compare risk data for its facilities and developed a new process to document risk-based technical findings and decisions. DOI Reclamation continues to refine its *Dam Safety Risk Analysis Methodology*, a working guideline on risk analysis methods and associated appendices that defines procedures for estimating risk. DOI Reclamation also participated in a workshop to



Hydraulic engineers work on combining SIMBA (Simplified Breach Analysis) with winDAM (Windows Dam Analysis Modules) to simulate stages of the dam-breach process. Photo courtesy Stephen Ausmus, USDA, Agricultural Research Service.

develop research needs related to outlet works and submitted final products for a similar workshop it hosted on spillways in FY 2003. DOI Reclamation led interagency efforts to develop expert-level documents on piping and conduits through embankment dams, geotextiles, and plastic pipes. Educational videos on dam breach modeling and flood routing were produced by DOI Reclamation and made available in FY 2005.

The FS reports that its Northern Region is in the process of developing inexpensive alternatives for satellite-based early warning/reservoir monitoring systems for placement on remote moderate and high-hazard potential dams. The first system was installed on a tailings impoundment dam during this reporting cycle.

The Agricultural Research Service (ARS) has an ongoing research program focused on understanding and predicting the performance of overtopped earth embankment dams (a list of ARS publications is available at www.ars.usda.gov/Services/Services.htm?modecode=62-17-10-00). In FY 2004 and 2005, this program included the study of the ability of an earth embankment dam to resist breach; the elapsed time from initial embankment overtopping to breach; the role of vegetal cover in delaying or resisting breach; the impact of embankment material properties on breach rate; and the mechanics of the erosion processes governing breach. The program included an international cooperation component (the United Kingdom,

Belgium, Spain, the Czech Republic, Norway, France, Italy, and Sweden) that was supported by the National Dam Safety Program through FEMA.

The latest ARS-developed earth spillway erosion model has been incorporated into existing NRCS SITES design software. The current version of SITES (2005) can be used to develop inflow hydrographs by NRCS curve number procedures, compute spillway system hydraulics, calculate peak reservoir elevations, and determine ultimate spillway headcut advance for a single dam or multiple sites in series. Various versions of SITES have been distributed and presented at recent ASDSO conferences. The latest ARS-developed embankment overtopping erosion model is being developed into new software named winDAM (windows Dam Analysis Modules) and the new ARS developed breach model will be added. NRCS also is developing an extensive concrete design handbook that will orient modern American Concrete Institute Codes with traditional dam concrete appurtenance design. NRCS recently produced a new flexible pipe design handbook in consultation with industry representatives that includes design guidance on the structural design of plastic and metal pipes in embankment dams.

State Dam Safety Agency Involvement

The Corps and ASDSO developed a partnership agreement that was finalized at the end of FY 2003. Some of the objectives of the partnership are to encourage continuing dialogue at the national and state levels on issues of importance to dam safety and the Nation; promote professional and ethical dam safety engineering practices; improve national security for all vulnerable dams by sharing expertise and experience; and increase diversity in the dam safety engineering profession.

Over the past 2 years, TVA has increased efforts to establish and maintain contact with state and local EMA's in areas affected by TVA dams. Activities by TVA emergency preparedness staff include attending state-sponsored regional meetings where revised EAP's are distributed and current dam safety activities are discussed with local and state EMA representatives; conducting visits with county EMA's to build working relationships and for EAP distribution and exercise planning and coordination; expanding the scope of functional exercises to involve state and local EMA's, including activation of local emergency operation centers and involvement of local government officials; and participating in the Winter Spill 2005 exercise conducted by the Kentucky Division of Emergency Management, Region 2.

At the state level, MSHA has been involved with representatives from regulatory agencies in many states on various issues related to impoundments and tailings dams. Districts also have been involved with the Hopi Tribe and Navajo Nation in Arizona when mining operations are located on their property.

FERC has continued its support of state dam safety programs through its policy of inviting state dam safety agencies on its inspections, providing copies of all dam safety information, and sharing its dam safety technology through its guidelines and training sessions. Where state dam safety agencies indicate an interest, particularly in current flood and seismic technology, FERC closely coordinates the specific dam safety issue.

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

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

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 MOU to regularly exchange information on dam safety activities, provide data to the NPDP, 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. Massachusetts, Missouri, Nevada, South Carolina, and West Virginia have MOU's with their state agencies.



Conemaugh River Lake, PA. Photo courtesy U.S. Army Corps of Engineers.

The Security of Our Nation's Dams

The establishment of the Department of Homeland Security (DHS) through the Homeland Security Act of 2002, the transition of the Federal Emergency Management Agency (FEMA) to DHS in March of 2003, and the issuance of Homeland Security Presidential Directive-7 (HSPD-7) in December 2003 resulted in a new organizational framework for focusing national efforts on homeland security.

This section of the biennial report describes national efforts to coordinate security issues relating to dams and new reporting and information sharing mechanisms established by DHS to focus these efforts. Also described in this section of the report are security-related activities conducted in Fiscal Year (FY) 2004 and 2005 under the National Dam Safety Program and dam security activities conducted in the same timeframe by some of the Interagency Committee on Dam Safety (ICODS) agencies.

Current DHS Efforts in Dam Security

The Homeland Security Act of 2002 charges DHS to lead a unified national effort to secure America, prevent and deter terrorist attacks, and respond to threats and hazards to the

Nation. To unify these efforts, DHS serves as the primary coordinator among federal departments and agencies, state and local governments, and the private sector to enhance critical infrastructure protection. In December 2003, the White House issued HSPD-7, entitled *Critical Infrastructure Identification, Prioritization, and Protection*, identified the 17 critical infrastructure/key resource (CI/KR) sectors, and assigned leadership for this cooperation and integration of efforts to Sector Specific Agencies (SSA). The Dam Sector is one of 10 sectors assigned to DHS as the SSA. The SSA lead responsibilities for the Dam Sector reside at the Risk Management Division (RMD) of the Office of Infrastructure Protection within the DHS Preparedness Directorate.

As a mechanism to coordinate information across all relevant government and private industry critical infrastructure stakeholders, DHS is establishing a system of National Coordination Councils. The Government Coordinating Council (GCC) and the Sector Coordinating Council (SCC) provide the forum for stakeholder coordination which includes sector-wide planning, development of sector best practices, sector-wide promulgation of programs and plans, development of requirements for effective information sharing, research and development, and cross-sector coordination.



Livingston, TX, September 26, 2005. Livingston Dam, damaged by Hurricane Rita, is examined by engineers. Photo courtesy of Skoogfors, FEMA.

The Dam Sector SCC, which met for the first time in May 2005, is composed of private owners, representatives from major utility companies such as Pacific Gas & Electric (PG&E) Company, Xcel Energy, CMS Energy, Duke Energy, and representatives from the Association of State Dam Safety Officials, the National Hydropower Association, and the United States Society on Dams. The SCC meetings are held quarterly.

The GCC, which met for the first time in January 2005, includes representatives from DHS and the federal agencies that own and/or regulate dams, including the Federal Energy Regulatory Commission (FERC), the Department of the Interior (DOI) Bureau of Reclamation (DOI Reclamation) and the DOI Office of Law Enforcement, Security, and Emergency

Management (OLESEM), U.S. Department of Agriculture (USDA), U.S. Army Corps of Engineers (Corps), Tennessee Valley Authority (TVA), Mine Safety and Health Administration, International Boundary and Water Commission (IBWC), and four state dam safety officials. Similar to the Dams SCC, the Dams GCC also meets quarterly. The Dams GCC is chaired by RMD, and participates in meetings with the National Dam Safety Review Board (Review Board) and ICODS.

DHS has developed information sharing and communication mechanisms, such as the Homeland Security Information Network (HSIN). A portion of this portal has been set up specifically for the Dam Sector and is a vehicle to communicate operational and threat information with appropriate dam stakeholders. DHS also has established the National Incident Management System (NIMS), which is required by HSPD-5, *Management of Domestic Incidents*. NIMS establishes a single, comprehensive system for incident management that fosters more efficient communication and coordination of multiple agencies and jurisdictions.

The GCC and SCC hold periodic joint meetings to address issues of common concern.

A number of joint GCC/SCC Workgroups have been established to address issues of utmost importance to both sector councils. The five GCC/SCC Workgroups are:

- **Asset Identification Workgroup:** The objective of this Workgroup is to review data needs on critical dam sector projects and/or critical project assets and develop and update a high-consequence project list for the dam sector.
- **Best Practices Workgroup:** This Workgroup will review, develop, and update relevant sector reference materials and consolidate existing knowledge into a best practices document.
- **Information Sharing Workgroup:** The objective of this Workgroup is to determine a communication framework to facilitate the exchange of information within the dam community.
- **Risk Assessment (RAMCAP) Workgroup:** This Workgroup will provide sector-specific expertise for development of a RAMCAP module for dams, establish criteria and guidelines for its testing and implementation, and evaluate its general applicability to the sector.
- **Research and Development Workgroup:** This Workgroup will identify, assemble, and compile all pertinent research and development (R&D) information applicable to the sector; evaluate sector R&D needs; and develop a plan of execution, with cost estimates.

Development of the National Infrastructure Protection Plan for Dams

A key requirement of HSPD-7 is the development of the National Infrastructure Protection Plan (NIPP). The NIPP describes activities to identify CI/KR; reduce the vulnerability of these assets; prioritize the assets; coordinate their protection; and share information. Input from all stakeholders from the private sector, state, local, and tribal governments, and the Federal Government are needed to prepare this plan. The NIPP includes the Base Plan and 17 Sector Specific Plans (SSP's) that form the appendices to the Base Plan.

The Dams SSP provides a detailed description of the specific processes that are used to identify, assess, prioritize, and protect dams; processes used to measure effectiveness; the plans for implementing these processes, including lists of projects, initiatives, activities, time frames, milestones, and resource requirements; and the status of any efforts being conducted to support the effort to date, including best practices identified, challenges encountered, and products generated. Work began on the first draft of the SSP in early 2004, employing a team of writers from DHS, FEMA, Corps, FERC, and DOI Reclamation. In early 2005, the writing teams were expanded to include representatives from the private sector and state and local government. The Dams SSP was revised in the summer 2005. A new and improved Dams SSP is being prepared to be in line with the soon to be released final version of the NIPP.

National Dam Safety Program Activities

As the lead agency for the National Dam Safety Program, FEMA has worked for years with the ICODS agencies, the states, and private industry on implementing requirements and initiatives for dam safety. FEMA now works with a number of organizations and employs different processes for involving dam sector stakeholders on issues of national concern, including the security of dams and related infrastructure. FEMA's continuing mission within DHS is to lead the effort to prepare the Nation for all hazards and to effectively manage federal response and recovery efforts following any national incident.

In February 2002, the Task Force on Dam Safety and Security was established to facilitate dialogue on dam security and to offer technical support on policy and guidance related to the security of the Nation's dams. The primary focus of the Task

Force, now the Review Board Work Group on Dam Security, has been to provide state dam safety officials with the best practices and guidelines for the screening and vulnerability assessment of dams.

In April 2004, FEMA hosted the first pilot security workshop for state dam safety officials. The Security and Anti-Terrorism (S/AT) Workshop covered the step-by-step procedures to develop a security for dams program at the state level and included detailed instruction and exercises on the use of risk for identifying dams vulnerable to terrorist attack. Feedback from the pilot course was used to revise the program of instruction and training materials for a model dam security program for state officials. A second S/AT Workshop for state dam safety officials was held in Phoenix, Arizona, at the end of July 2005.

Federal Agency Programs in Dam Security

Many of the federal agencies that initiated security activities in FY 2002 have further strengthened their security and safety programs during FY 2004 and 2005. Some of these activities by the ICODS agencies are described below.

U.S. Army Corps of Engineers

Well before September 11, 2001, the Corps was developing procedures for assessing security risks and designing security upgrades for its high risk projects. After September 11, 2001, the Corps embarked on an aggressive program of training personnel to apply the Risk Methodology for Dams (RAM-D) procedure developed by Sandia National Laboratories under contract to the Corps. The RAM-D product was delivered in August 2001. By the end of FY 2005, the Corps had completed risk analyses for 353 of its most critical projects. The Corps is implementing various levels of security enhancement to eventually achieve a baseline security level for all of its projects. The Corps is the central point of collection of information and intelligence analysis for suspicious and threatening events at dams. The Corps works in collaboration with DOI Reclamation, FERC, and DHS to collect and analyze this data to identify trends and properly assess the relative importance of the incident. The Corps is developing a suite of software analysis tools, AT-Planner for Dams, for assessing the damage that differing levels of explosives threats can cause to the components at a dam or lock and dam facility. This suite of blast effects and remedial design tools is being developed in partnership with DOI Reclamation. The Corps also is improving the resolution of its water management modeling to more accurately estimate water levels in the event of an unplanned water release.

International Boundary and Water Commission

Both the United States and Mexican Sections of the IBWC have tightened access to their respective projects. The IBWC has prepared a Binational Action Plan for the United States/Mexico Border for Critical Infrastructure Protection. The Plan identifies specific security projects that are needed for each dam to improve security. IBWC reports that it is waiting for funding to implement the projects. The USIBWC recently completed security assessments of its two largest dams in collaboration with a multidisciplinary team lead by security specialists from the DHS RMD.

Federal Energy Regulatory Commission

The FERC Security Program for Hydropower Projects was created in FY 2002. The Security Program provides guidance to FERC staff and licensees to coordinate and complete security activities at hydropower dams under FERC jurisdiction. Shortly after September 11, the 2,500 FERC jurisdictional dams were divided into three security groups (Groups 1, 2, and 3) based on the severity of potential consequences of an attack and the “attractiveness” of the dam as a target.

42 Approximately 200 dams were categorized as Security Group 1, approximately 1,000 dams as Security Group 2, and the remaining dams (all low-hazard potential dams) as Security Group 3. This program is designed to be adaptable as industry gains knowledge of security at dams.

In FY 2004 and 2005, the following security activities were completed by FERC:

- Jurisdictional dams were inspected for the adequacy of on-site security.
- The Dam Assessment Matrix for Security and Vulnerability Risk (DAMSVR) was created and distributed to licensees and other dam security specialists.
- FERC staff participated in several national working groups and committees to coordinate the national response to security at dams.
- FERC staff participated in the creation of the Dam Sector GCC and in the development of the Dam SSP as part of the NIPP.

Over the next 2 years, FERC will continue to focus on the following hydropower security work initiatives:

- The FERC Security Task Force, which is composed of FERC staff and licensees, will continue to monitor the security program so that adjustments can be made to the program based on developing knowledge.

- Research and development on issues critical to dam security will continue by FERC and other federal agencies, including the Corps and DOI Reclamation.
- The need to periodically update and refine vulnerability assessments at FERC jurisdictional dams will be delineated.
- Jurisdictional dams will continue to be inspected for the adequacy of on-site security (annual basis).
- Upgrades and modifications to security at jurisdictional dams, based on the licensee agreements completed in September 2003, will be monitored and assessed by FERC engineers.

Department of the Interior

In FY 2004 and 2005, the DOI continued to pursue an aggressive program to address critical health, safety, and security needs at all dams, buildings, and facilities. DOI manages an extensive infrastructure to meet the needs of more than 422 million annual visitors who enjoy National Parks, National Wildlife Refuges, and other public lands and facilities.

On November 15, 1989, DOI chartered the Working Group on Dam Safety and Security (WGDSS). The charter, which was revised and updated to include dam security, was adopted by the Secretary of the Interior on November 26, 2003. The WGDSS is chaired by the Commissioner of Reclamation and includes members that represent the Office of the Secretary; the Office of the Solicitor; the Assistant Secretary-Fish and Wildlife and Parks; the Assistant Secretary-Indian Affairs; the Assistant Secretary-Land and Minerals Management; the Assistant Secretary-Policy, Management, and Budget; and the Assistant Secretary-Water and Science.

To assist the Assistant Secretaries in resolving dam safety issues, the WGDSS was chartered to perform the following tasks:

- Provide a forum for the discussion and resolution of dam safety and dam security issues within the Department, and to make recommendations to the Secretary of the Interior.
- Coordinate the Department’s priority ranking system for dam safety and dam security work.
- Provide a mechanism for the exchange and dissemination of information, education, and training within the Department that relate to dam safety and dam security.
- Maintain communication with other federal and non-federal entities concerned with dam safety and dam security issues.
- Review the emergency management activities associated with dams.



Hydraulic engineers view the start of a headcut-widening test, which will help them understand the widening component of the dam-breach process.
 Photo courtesy Stephen Ausmus, U.S. Department of Agriculture, Agricultural Research Service.

- Coordinate and conduct periodic peer reviews of Bureau dam safety programs or dam security assignments, and assist in a Bureau’s response to recommendations.
- Facilitate interagency coordination and resource sharing and assistance regarding all aspects of dam safety and security.
- Coordinate the preparation of any reports requested by the Department or other federal entities.
- Coordinate the submission of data to the National Inventory of Dams.
- Provide recommendations to the Department for updating the Departmental Manual, Part 753, Dam Safety and Security Program.

Department of the Interior Bureau of Reclamation: DOI Reclamation is the Nation's largest wholesale water supplier with a large inventory of water resource infrastructure. The inventory includes five National Critical Infrastructure (NCI) facilities and 471 dams and appurtenant facilities that could threaten the public if they were to fail. The inventory also includes 58 hydroelectric power plants that generate 42 billion kilowatt hours annually, making DOI Reclamation the

second largest hydropower producer and the tenth largest utility. DOI Reclamation's reservoirs have a capacity of 245 million acre feet of storage, enough to serve 31 million people and 10 million farm land acres. In addition, DOI Reclamation’s facilities and reservoirs provide popular recreation destination to the public and have a high level of visitation.

Public access to DOI Reclamation facilities through state, local, and project roads brings the public in close proximity to these dams and powerhouses. This access is a potential vulnerability to acts of sabotage and terrorism. If attacked, these facilities could cause significant loss of life and serious economic impacts from the subsequent downstream flooding and the elimination of the water supply or hydropower generation capabilities.

To address the vulnerabilities of its facilities, DOI Reclamation uses a comprehensive security review and assessment program. These reviews and assessments provide the basis for any necessary security upgrades and enhancements to safeguard DOI Reclamation's personnel, facilities, buildings, properties, and the public.

DOI Reclamation's comprehensive security risk assessment process:

- Identifies the specific assets (features) at a facility that, if successfully exploited, could cause adverse consequences to occur;
- Identifies and assesses potential threats to a facility;
- Determines the consequences arising from an undesirable event; and
- Evaluates the effectiveness of the existing security system.

On completion of the assessment, DOI Reclamation management teams consider proposed recommendations for corrective actions or security mitigation improvements to diminish the risks of failure, loss, and the adverse impacts related to specific facility components. This methodology provides a cost-effective means of evaluating threats to facility features that may pose the most critical security risks, and leads toward suggested changes to provide the greatest risk reduction. The security risk assessment process has been used for all facilities in DOI Reclamation's security inventory and recommendations identified in the assessment process continue to be implemented based on priority and funding.

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The resulting comprehensive protection program encompasses a coordinated plan of action to detect, delay, assess, and respond to incidents or terrorist-type attacks on dams and related assets. The protective program includes measures such as guards, surveillance, equipment fortification, information security, law enforcement, and emergency management activities.

Department of the Interior, U.S. Fish and Wildlife Service:

As a result of the September 11 terrorist attacks, the DOI Fish and Wildlife Service undertook a five-phase initiative to evaluate, prioritize, and correct security deficiencies at its high- and significant-hazard potential dams. These deficiencies identified the need to include access control, security fencing, locks, locking gates, barricades, bollards, and locking controls. All work was completed by the end of FY 2005.

Tennessee Valley Authority

The TVA operates a system of 49 dams and reservoirs on the 652-mile-long Tennessee River and its tributaries. The TVA, which initiated a Hydro Security Program in FY 2003, has performed security assessments using the RAM-D program of its 29 high-hazard potential dams. As a result of these assessments, security upgrades have been completed on all main-river dams and have begun on several tributary dams. TVA's initial work focused on the main-river sites, with

priority given to visitor centers and Corps lock facilities. TVA also has improved internal emergency procedures, communications, and coordination. TVA has developed and implemented an agency emergency response plan that provides for coordinated internal response to agency-level threats of all types. The resulting Agency Command Center performs annual drills to ensure effective emergency response. TVA also is in the process of implementing the NIMS, as required by HSPD-5, *Management of Domestic Incidents*. The TVA NIMS Implementation Plan was adopted on March 8, 2005, and should be fully integrated into TVA's emergency response plans, procedures, training, and exercises by March 31, 2006.

U.S. Department of Agriculture, Natural Resources Conservation Service

The USDA Office of Inspector General (OIG) audit of security in the Natural Resources Conservation Service (NRCS) following the September 11 attacks included an assessment of NRCS activities related to dams. NRCS agreed with OIG to complete the hazard classification update of all NRCS-assisted project dams that permanently store water supply or irrigation by October 2004, and all remaining NRCS-assisted projects by October 2005. NRCS has added a data field for the date of latest hazard classification verification to the NRCS dam inventory to measure completion of this work.



Glen Canyon Dam, AZ. Photo courtesy U.S. Army Corps of Engineers.

Focus on the Future

Over the next 2 years, there will continue to be challenges for everyone in the dam safety and security community. To address these challenges, the Federal Emergency Management Agency (FEMA) and the National Dam Safety Review Board (Review Board) developed performance measures in Fiscal Year (FY) 2005 that will lay the groundwork for both short- and long-term goals and priorities for the National Dam Safety Program over the next 5 to 10 years. Some of these goals and priorities are discussed below.

Identify and Remediate Deficient Dams

The aging of dams in the United States continues to be a critical issue for dam safety. The *2005 Report Card for America's Infrastructure* (American Society of Civil Engineers, March 2005) states that the number of unsafe or deficient dams in the United States has risen by more than 33 percent since 1998, to more than 3,500. These statistics focus on the crux of one of the most important issues: the aging of the Nation's water control infrastructure and how we will cope with the problem in an era of diminishing resources. The *Report Card* states that while federally owned dams are in good condition,

and there have been modest gains in repair, the number of dams identified as deficient is increasing at a faster rate than those dams that are being repaired.

The dam safety community is working on a number of options to address the remediation of deficient dams, including model loan programs for the repair of dams, dam removal projects, and rehabilitation programs. Some progress is being made through the repair of small watershed dams constructed with assistance from the U.S. Department of Agriculture. Although the Dam Safety and Security Act of 2002 states that funds provided to the states cannot be used for the construction or rehabilitation of dams, and as such cannot be used to measure performance, it is the intent of the National Dam Safety Program to track data on the identification and remediation of high-hazard potential deficient dams as an indication of overall progress.

Increase Inspections of Dams

As described above in this report, the number of dam inspections conducted by the states remained fairly constant compared to the last reporting period, but has increased

dramatically since data was first collected for 1998-1999, from a total of approximately 12,000 inspections for 1998-1999 to nearly 15,000 inspections in 2004. The tracking of data on inspections should provide valuable information to identify those dams in the United States that are in need of remediation.

Increase the Number and Updates of Emergency Action Plans

Emergency action planning continues to be of critical importance to the safety and security of dams in the United States. Approximately 60 percent of non-federal high-hazard potential and significant-hazard potential dams do not have an Emergency Action Plan (EAP) to address the potential for loss of life and damage to property and the environment should the dam fail. EAP's are the principle tool used by first responders to warn and evacuate the vulnerable population below the dams. This is one of the six initiatives for dams discussed in the U.S. Department of Homeland Security *National Strategy for the Physical Protection of Critical Infrastructure and Key Assets* and one of the performance measures developed by the Review Board. The exemplary emergency action planning program established by the Federal Energy Regulatory Commission (FERC) incorporates all of the procedures and products needed for the implementation and exercise of EAP's among all sectors.

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Achieve the Participation of all States in the National Dam Safety Program

At the end of the last reporting period, Delaware and Alabama were the only states not participating in the National Dam Safety Program. In July 2004, the Delaware Governor signed House Bill 514, which establishes a dam safety program in the Delaware Department of Natural Resources and Environmental Control. The legislation, which was unanimously passed by the Senate in June 2004, authorizes the Department to adopt standards for maintenance and operation of publicly owned dams and to conduct dam inspections. One of the goals of the National Dam Safety Program is for the State of Alabama to enact legislation so that it can participate in the Program.

Increase Number of Stakeholders Trained in Dam Safety Programs

It is a goal of the National Dam Safety Program to develop a national dam safety training program that will provide for a cycle of continuous technical training to meet the dynamic

needs of the dam safety community, including government, consulting engineers, dam owners, the emergency management community, and other professionals. The Review Board Training Work Group and the new Interagency Committee on Dam Safety (ICODS) Subcommittee on Federal Training Resources are working cooperatively to establish the parameters of a national dam safety training program.

Increase Research Products Disseminated to the Dam Safety Community

The majority of research projects approved for National Dam Safety Program funding generate a research product, such as a technical manual or guideline, based on the priorities established in the 5-year Strategic Plan for Dam Safety Research. In FY 2004 and 2005, a number of products were developed that address research topics identified in Strategic Plan. A goal of the National Dam Safety Program is to continue to generate research products of use to the dam safety community. Efforts also are underway to harmonize the 5-year Strategic Plan with the dam security research plan being developed for the Dam Sector Annex to the National Infrastructure Protection Plan.

Achieve Cost Efficiencies

Achieving cost efficiencies are critical to the ability of FEMA to meet its obligations under the Government Performance Results Act (GPRA). One of FEMA's goals for the National Dam Safety Program is to increase efficiencies in the publication and distribution of National Dam Safety Program resource materials, increase the access to the resource materials, and maintain the quality of the materials. FEMA is now moving toward a web-based and CD-ROM publication and dissemination structure for the majority of its materials. The increased use of these publication technologies should result in annual reductions each year in printing and distribution costs for National Dam Safety Program resource materials.

The Dam Safety Program Management Tools (DSPMT) program, which has received major emphasis and funding under the National Dam Safety Program, continues to collect valuable data on the status of dams and dam safety programs in the United States. This software program, which is operated and maintained by the U.S. Army Corps of Engineers, is generating data for the evaluation of the "health and progress" of dam safety programs on the national scale. The DSPMT will be an important tool in the collection of data for measuring progress in dam safety during the next reporting cycle.

List of Acronyms and References

ARS	Agricultural Research Service	EMA	Emergency Management Agency
ASCE	American Society of Civil Engineers	EMI	Emergency Management Institute
ASDSO	Association of State Dam Safety Officials	FEAP	Flood Emergency Action Plan
ASFPM	Association of State Floodplain Managers	FEMA	Federal Emergency Management Agency
BIA	Bureau of Indian Affairs	FERC	Federal Energy Regulatory Commission
BLM	Bureau of Land Management	FOIA	Freedom of Information Act
BSP	Baseline Security Posture	FS	U.S. Forest Service
CI/KR	Critical Infrastructure/Key Resources	FSA	Farm Service Agency
CIP	Critical Infrastructure Protection	FTE	Full-Time Equivalent
CISP	Critical Infrastructure Security Program	FWS	U.S. Fish and Wildlife Service
CRS	Community Rating System	FY	Fiscal Year
CWCISRP	Civil Works Critical Infrastructure Security Research Program	GAO	General Accounting Office
DAMSVR	Dam Assessment Matrix for Security and Vulnerability Risk	GCC	Government Coordinating Council
DHS	Department of Homeland Security	GIS	Geographic Interface System
DOE	Department of Energy	HEC-HMS	Corps Hydrologic Engineering Center Hydrologic Modeling System
DOI	Department of the Interior	HEC-RAS	Corps Hydrologic Engineering Center River Analysis System
DOL	Department of Labor	HSPD	Homeland Security Presidential Directive
DSPMP	FERC Dam Safety Performance Monitoring Program	IBWC	International Boundary and Water Commission
DSPMT	Dam Safety Program Management Tools	ICODS	Interagency Committee on Dam Safety
DSPPM	Dam Safety Program Performance Measures	MBDSI	Multi-Hazard Building Design Summer Institute
D2SI	FERC Division of Dam Safety and Inspections	MOU	Memorandum of Understanding
EAP	Emergency Action Plan	MSHA	Mine Safety and Health Administration
		NCI	National Critical Infrastructure

NEMA	National Emergency Management Association
NID	National Inventory of Dams
NIMS	National Incident Management System
NIPP	National Infrastructure Protection Plan
NPDP	National Performance of Dams Program
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OIG	Office of Inspector General
OLESEM	Office of Law Enforcement, Security, and Emergency Management
O&M	Operation & Maintenance
OSM	Office of Surface Mining
PG&E	Pacific Gas & Electric
RMD	Risk Management Division
S/AT	Security and Anti-Terrorism
SSA	Sector-Specific Agency
SSC	Sector Coordinating Council
SSP	Sector Specific Plan
SEED	Safety Evaluation of Existing Dams
SOP	Standard Operating Procedure
TADS	Training Aids for Dam Safety
TVA	Tennessee Valley Authority
USDA	U.S. Department of Agriculture
48 USGS	United States Geological Survey
USIBWC	U.S. Section, IBWC
USSD	United States Society on Dams
WGDSS	Working Group on Dam Safety and Security

¹ The *Federal Guidelines for Dam Safety* were prepared by the Ad Hoc Interagency Committee on Dam Safety of the Federal Coordinating Council for Science Engineering and Technology, June 25, 1979 (Washington, D.C.) (FEMA 93). The *Federal Guidelines for Dam Safety* were reprinted in 1998. Federal Guidelines addressing specific areas relating to dam safety also have been updated and/or reprinted, (See FEMA 94, April 2004; FEMA 148, April 2004; FEMA 333, April 2004; FEMA 64, April 2004; and FEMA 65, May 2005).

² Id.

