

# CRS Report for Congress

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## **Aging Infrastructure: Dam Safety**

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# Aging Infrastructure: Dam Safety

## Summary

While dams have multiple benefits, they also represent a risk to public safety and economic infrastructure. This risk stems from two sources: the likelihood of a dam failure and the damage it would cause. While dam failures are infrequent, age, construction deficiencies, inadequate maintenance, and seismic or weather events contribute to the likelihood. To reduce the risk, regular inspections are necessary to identify deficiencies and then corrective action must be taken.

To identify deficiencies that could cause dam failures, the federal government established inspection requirements for the nation's federal dams. Once deficiencies are identified, most agencies finance repairs through their operation and maintenance accounts. Funding mechanisms vary for larger rehabilitation activities. At the Bureau of Reclamation, for example, most larger repairs are conducted with annual appropriations to its dam safety program. At some other agencies, dam rehabilitation must compete with other construction projects for funding.

At non-federal dams, safety is generally a state responsibility, though some federal assistance has been provided. Funding through the National Dam Safety Program, which is authorized through FY2006, helps states improve their dam safety programs and train inspectors. In addition, the Federal Energy Regulatory Commission and the Department of Labor, Mine Safety and Health Administration require regular inspections at the non-federal dams within their jurisdiction. Even so, there are concerns that most state dam safety programs have inadequate staff and funds to effectively inspect or monitor all of the dams for which they are responsible. Further, there are concerns that states, local governments, and other non-federal dam owners may not have the financial resources to maintain and rehabilitate their dams.

Following the failure of the levee at Lake Pontchartrain in 2005, it is likely that there will be increased scrutiny of flood control infrastructure and the structural stability of high hazard-potential dams. Further, there has been periodic pressure for Congress to pass legislation authorizing federal support for rehabilitation work at non-federal dams. Demand for such assistance is likely to increase, but there is currently no federal policy that describes the conditions under which federal funding is appropriate, nor has Congress established criteria for prioritizing funding among non-federal projects.

To help inform discussions on the federal role in dam safety, this report provides background information on the nation's dam safety activities and funding mechanisms. It will not be updated.

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# Aging Infrastructure: Dam Safety<sup>1</sup>

## Introduction

Dams provide broad economic and social benefits, including flood control, hydroelectric power, recreation, navigation, and water supply for drinking, irrigation and industrial uses. Dams also represent a risk to public safety, local and regional economies, and the environment.

Prior to the events of September 11, 2001, Congress had expressed an increasing interest over several decades in dam safety. In recent years, congressional interest focused largely on securing and protecting U.S. dams and water storage facilities from terror attacks. Following Hurricane Katrina and the disastrous failure of levees that once protected New Orleans, however, there may be renewed interest in the structural integrity of other major water infrastructure.

The modern period of congressional concern began in the 1970s with dam failures that resulted in loss of life and billions of dollars in property losses.<sup>2</sup> Congress and private groups interested in dam safety noted that, while states and localities are responsible for the maintenance and safety of 95% of the nation's dams, large numbers of older dams lacked the maintenance needed to guarantee operational integrity and prevent failure. These aging dams presented then — and continue to present — a potential hazard to downstream populations.

Following the first of these dam failures, an essential first task was to develop accurate data on the nation's dams: their number, type, structural condition, and other information useful for making decisions about dam safety policy and priorities. This was achieved through creation in 1972 of the National Inventory of Dams (NID)<sup>3</sup> — a computerized, periodically updated<sup>4</sup> catalogue of U.S. dams, maintained by the U.S.

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<sup>1</sup> This report was prepared with assistance from Richard Sachs, Congressional Research Service.

<sup>2</sup> In 1972, failure of a mine tailings dam at Buffalo Creek, WV flooded a 16-mile valley and killed 125 people. In 1976, Teton Dam in Idaho failed, causing \$1 billion in property damage and killing 11. Kelley Barnes Dam, GA failed in 1977.

<sup>3</sup> The NID was first authorized in the National Dam Inspection Act of 1972, P.L. 92-367 and later consolidated under the Water Resources Development Act of 1996, National Dam Safety Program Act, P.L. 104-303, Title II §215 (33 U.S.C. §467). The NID is available at [<http://crunch.tec.army.mil/nid/webpages/nid.cfm>].

<sup>4</sup> The NID was last updated in Feb. 2005.

Army Corps of Engineers — that presently lists 79,777 public and private “dams.”<sup>5</sup> For the purposes of the NID, a dam is defined as “any artificial barrier that has the ability to impound water ... for the purpose of storage or control of water” that (1) is greater than 25 feet in height with a storage capacity of more than 15 acre-feet<sup>6</sup> (af), (2) is greater than 6 feet in height with a storage capacity of more than 50 af, or (3) poses a significant threat to human life or property should it fail.

Federal and non-federal dams in the NID were constructed for a variety of purposes. By far, the greatest number of dams — approximately a third — were constructed primarily for recreational purposes. About 21.4% were built primarily for fire protection. The others, in descending order of their primary purpose, are: flood control (16.4%); irrigation (10.1%); water supply (7.4%); hydroelectric (2.7%); fish and wildlife (1.3%); mining (tailings dams) (1.2%); debris control (0.8%); and navigation (0.1%). Approximately 8.7% of the dams in the NID have other primary purposes, or those purposes are unspecified.<sup>7</sup> While these are the primary purposes, many dams have multiple uses.

Nearly 56% of dams in the NID are privately owned. (See **Figure 1**.) Slightly more than 20% are owned and operated by local — county or municipal — governments. About 4.8 % of dams are owned by states and 2.4% by public utility companies. The federal government owns only 4.7% of all NID dams, but this small number (somewhat more than 3,700) includes the dams many Americans view as iconic: the great hydroelectric dams of the West, like Grand Coulee and Hoover.<sup>8</sup> The ownership of some NID dams is not indicated in the database because that information was not reported to the Corps.

While the federal government owns less than 5% of NID dams, more than 30% of all dams in the NID inventory were funded, designed, or constructed with federal resources, most of them through the Department of Agriculture’s Natural Resources Conservation Service (NRCS). NRCS’ involvement in dam construction stems primarily from the Watershed Protection and Flood Prevention Act of 1954,<sup>9</sup> which authorized it to cooperate with states and local agencies to undertake works of improvement for flood prevention and other purposes. Under this act and an earlier law to build projects in 11 designated watersheds, NRCS helped build more than 10,000 upstream flood control dams beginning in 1948. These are generally relatively small dams owned by public or private entities other than the federal

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<sup>5</sup> Other sources cite different figures; the online NID data is used throughout this report unless otherwise specified. When appropriate, this data will be referred to as *NID Data*, 2005.

<sup>6</sup> One acre-foot of water is the amount of water that will cover an acre of land to a depth of one foot, approximately 326,000 gallons.

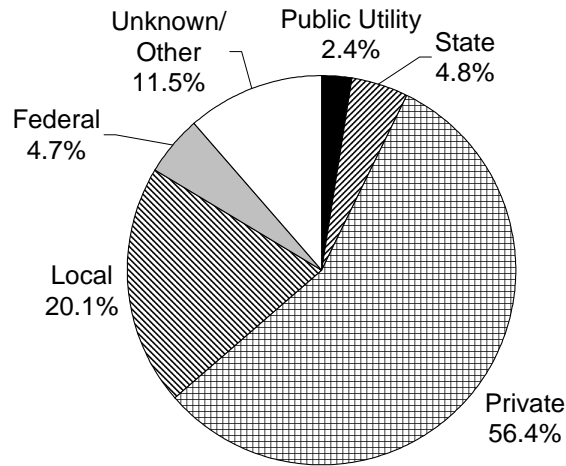
<sup>7</sup>*NID Data*, 2005.

<sup>8</sup>U.S. Dept. of Homeland Security, Federal Emergency Management Agency, *The National Dam Safety Program Fiscal Years 2000-2001*(Washington, DC: December 2001), p. 6 (Hereafter, cited as *FEMA report*, 2000-2001). Available at [<http://www.fema.gov/fima/damsafe/dsreport3.shtm>] on Sept. 14, 2005.

<sup>9</sup>Watershed Protection and Flood Prevention Act, P.L. 83-566.

government. These non-federal entities are principally responsible for the dams' operation, maintenance, and security.<sup>10</sup>

**Figure 1. Dam Ownership**



Excluding the NRCS, which does not own any dams, nine federal agencies own, operate, or regulate dam safety at approximately 8,500 sites (including non-NID dams).<sup>11</sup> Six federal agencies own NID dams. These are: the Department of Defense (862), Department of the Interior (750), Department of Agriculture (326), Tennessee Valley Authority (83), Department of Energy (16), and the State Department (7). In addition, 3 agencies regulate, but do not own NID dams: the Federal Energy Regulatory Commission (FERC) regulates 1,775 hydropower dams; the Department of Labor, Mine Safety and Health Administration regulates 745 dams; and the Nuclear Regulatory Commission regulates 11 dams. While dams owned by one agency are not generally regulated by another agency, there are cases where private hydroelectric projects, regulated by FERC, are located at federal dams.

Congressional interest in dam safety generally falls into three areas: (1) dam security and the potential for acts of terrorism at major U.S. dam sites; (2) prevention of potential dam failures due to structural deficiencies; and (3) recovery from dam failures. This report focuses on the second category because it is a topic that will likely become more important as the nation's dams age; further it is likely to gain additional attention in the aftermath of Hurricane Katrina.

<sup>10</sup>U.S. Dept. of Agriculture, Natural Resources Conservation Service, *A Report to Congress on Aging Watershed Infrastructure* (Washington, DC: June, 2000), p. 1-2. Hereafter, cited as *NRCS Report*, 2000.

<sup>11</sup>*FEMA Report*, 2000-2001, p. 8-9. This figure differs from the NID-based data on dam ownership shown in **Table 2**. Some of these dams may not qualify for inclusion in the NID.

## Dam Failure Risk

While dams have multiple benefits, their failure or misoperation could threaten public safety, local and regional economies, and the environment. Risk has two primary components: (1) the damage and deaths associated with dam failure or misoperation, and (2) the likelihood of such a failure.

### Damage

To quantify the potential harm associated with a dam's failure, the Interagency Committee On Dam Safety prepared a hazard potential classification system.<sup>12</sup> As described in **Table 1**, the three hazard ratings (low, significant, and high) do not indicate the likelihood of failure, but reflect the *amount and type of damage* that a failure would cause. Hazard ratings for each dam are included in the NID. From 2000 to 2005 the number of high hazard dams increased from 9,921 to 11,811. According to FEMA, development below dams is the primary factor increasing dams hazard potential.<sup>13</sup>

**Table 1. Hazard Level: Description and Number**

Hazard Classification	Result of Failure or Misoperation	Number of Dams
<b>High Hazard</b>	— Loss of life is probable.  — Other economic or environmental loss possible, but not necessary for this classification.	11,811
<b>Significant Hazard</b>	— No probable loss of human life.  — Could result in economic loss, environmental damage, and disruption of lifeline facilities, etc.	13,407
<b>Low Hazard</b>	— No probable loss of human life.  — Few economic or environmental losses; losses are generally limited to the owner.	54,349

The hazard level of 210 dams was not reported to the Corps for inclusion in the NID. *NID Data, 2005.*

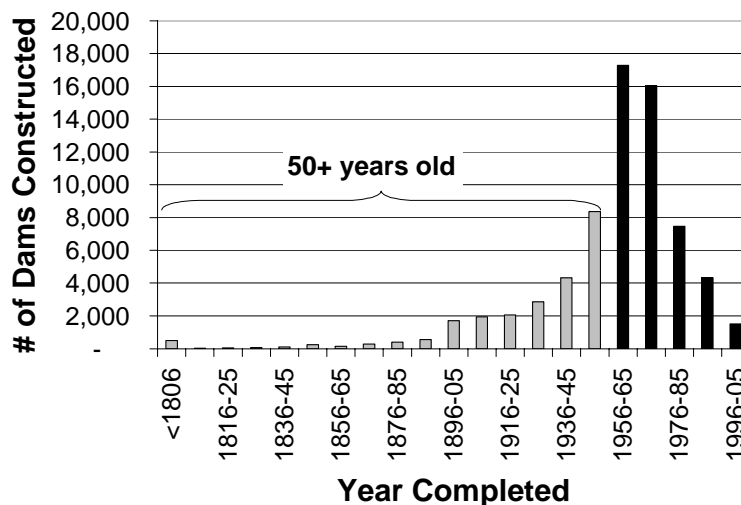
<sup>12</sup> Interagency Committee on Dam Safety, *FEMA 333. Federal Guidelines on Dam Safety: Hazard Potential Classification System for Dams* (Oct. 1998, reprinted Jan. 2004).

<sup>13</sup> Federal Emergency Management Agency, *FEMA 466: Dam Safety and Security in the United States: A Progress Report on the National Dam Safety Program in FY 2002 and 2003.*

## Likelihood of Failure

While catastrophic dam failures are fairly infrequent, states reported 1,090 dam safety incidents—including 125 failures—between 1999 and 2004.<sup>14</sup> A number of factors, including age, construction deficiencies, inadequate maintenance, and seismic or weather events, contribute to the likelihood of dam failure. For example, some failures are the direct result of flows larger than the dams were built to withstand. With the exception of seismic or weather events, age is a leading indicator of dam failure. In particular, the structural integrity and operational effectiveness of dams may deteriorate with age and some older dams do not comply with current dam safety standards established in the 1970s.<sup>15</sup> Overall, more than 30% of all dams in the National Inventory are at least 50 years old, the design life of many dams, and more than 17,000 will cross this threshold over the next 10 years. (See **Figure 2.**) According to the Association of State Dam Safety Officials, in 2003, approximately 3,243 U.S. dams had deficiencies that left them more susceptible to failure.<sup>16</sup> In

**Figure 2. Construction of Federal and Non-Federal Dams**



<sup>14</sup> National Performance of Dams, Dam Incidents Statistics Calculator. Available Sept. 14, 2005, at [<http://npdp.stanford.edu/index.html>]. This database provides a low estimate of dam safety incidents, since reporting is voluntary; few private or local dams are included.

<sup>15</sup>Eugene P. Zeizel and Robert H. Dalton, “Aging of Dams and Urban Development Require Major Dam Rehabilitation Efforts: A Growing Problem in Floodplain Management,” presented at the Annual Conference of the Association of State Flood Plain Managers, Charlotte, NC (June 3-8, 2001). This report indicated that 85% of all U.S. dams (not just NID dams) will be more than 50 years old by 2020.

<sup>16</sup>Association of State Dam Safety Officials, *State by State Statistics on Dams and State Safety Regulation — 2004*. Available Sept. 14, 2005, at [<http://www.damsafety.org/documents/Word/2004Stats.doc>].

In 2003, FEMA reported that there were more than 2,600 unsafe dams based on a report by (continued...)



2000, another report estimated that more than \$30 billion will be needed to repair and rehabilitate the nation's aging dams.<sup>17</sup>

## Managing Dam Safety

Following dam failures at Buffalo Creek (WV, 1972), Teton Dam (ID, 1976), and Kelly Barnes Dam (GA, 1977), legislative and executive actions established a program for monitoring the nation's dams and set guidelines for dam safety at federal facilities. Subsequent legislation promotes state dam safety programs and facilitates rehabilitation activities at federal and some non-federal dams.

### Federal Management

Through legislative and executive actions, the federal government has become involved in multiple areas of dam safety. First, in 1972, Congress passed the National Dam Inspection Act (P.L. 92-367) which authorized the Corps to undertake a program of national dam inspections and to establish the National Inventory of Dams. Activities under this law provided the impetus for broad scale monitoring and a centralized location for information on many of the nation's dams.

In 1977, following the failure of Teton Dam and Kelly Barnes Dam, President Jimmy Carter ordered a review of federal dam safety activities and subsequently the *ad hoc* Interagency Committee on Dam Safety released safety guidelines for dams regulated by federal agencies.<sup>18</sup> The *Federal Guidelines for Dam Safety* establish a basic structure for agencies' dam safety programs. In general, the guidelines encourage federal agencies, and dam-owners regulated by federal agencies, to abide by strict safety standards. They direct that each agency with dam safety responsibilities<sup>19</sup> have a dam safety officer and that the agencies coordinate with other agencies. It also establishes guidelines for staff training, periodic evaluations, documenting dam safety activities, and operation and maintenance.

In addition to the *Federal Guidelines for Dam Safety*, Congress enacted the Reclamation Safety of Dams Act (P.L. 95-578, 43 U.S.C. §508) in 1978 to set more

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<sup>16</sup>(...continued)

the American Society of Civil Engineers entitled *The 2003 Progress Report for America's Infrastructure* (Sept. 4, 2003).

<sup>17</sup>Raul F. Silva, "A Methodology and Estimate of the National Cost for Dam Safety Rehabilitation," presented at a conference of the Association of State Dam Safety Officials, Providence, RI (Sept. 27, 2000).

<sup>18</sup> Interagency Committee on Dam Safety, and U. S. Dept. of Homeland Security, Federal Emergency Management Agency, *Federal Guidelines for Dam Safety* (June 1979 reprinted April 2004).

<sup>19</sup>Agencies with dam safety responsibilities include the Tennessee Valley Authority, Federal Energy Regulatory Commission, and the Departments of Agriculture, Defense, Energy, the Interior, Labor, and State.

detailed guidelines for the Bureau of Reclamation.<sup>20</sup> This act authorizes Reclamation to preserve the structural stability of its dams and related facilities by performing modifications.

## State Dam Safety Programs

States have primary responsibility for the safety of 95% of the nation's dams. According to the Association of State Dam Safety Officials, every state but Alabama and Delaware<sup>21</sup> has a dam safety regulatory program.<sup>22</sup> Typically these programs include “(1) safety evaluations of existing dams, (2) review of plans and specifications for dam construction and major repair work, (3) periodic inspections of construction work on new and existing dams, and (4) review and approval of emergency action plans.”<sup>23</sup> Many states dam safety programs are often poorly funded. In 2004, state budgets for dam safety — which averaged \$742,000<sup>24</sup> — ranged from less than \$50 per state regulated dam (IA, IN, KS, MS, OK and TX) to more than \$16,000 per dam regulated by Puerto Rico.<sup>25</sup>

**Federal Support for State Dam Safety Programs.** While federal activities in the 1970s generally focused on increasing dam safety information and strengthening requirements at the nation's federal dams, subsequent legislation began to address the safety of non-federal dams. In 1996, Congress created the National Dam Safety Program (NDSP)<sup>26</sup> and assigned responsibility for administering it to FEMA. The NDSP is the nation's principal dam safety program; prior to creation of the program, there was no comprehensive national effort devoted to dam safety and the safety of downstream populations.

**Management of the NDSP.** The NDSP is a mechanism for federal and state cooperation that includes an Interagency Committee on Dam Safety (ICODS) with the Director of FEMA as its chair. ICODS, which was initially formed in 1980, is comprised of representatives from the FERC, the International Boundary Water Commission, the Nuclear Regulatory Commission, the Tennessee Valley Authority and the Departments of Agriculture, Defense, Energy, the Interior, Labor, and

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<sup>20</sup>While the Bureau of Reclamation owns the most dams, the U.S. Army Corps of Engineers owns the most NID dams.

<sup>21</sup> Alabama has 1,403 dams and Delaware has 61 dams.

<sup>22</sup>Association of State Dam Safety Officials, *State by State Statistics on Dams and State Safety Regulation — 2004*.

<sup>23</sup>Ibid.

<sup>24</sup>Average of reported state budgets. Excludes Delaware, Louisiana, Michigan, Nevada, South Carolina, and South Dakota did not report their dam safety budgets. Association of State Dam Safety Officials, *State by State Statistics on Dams and State Safety Regulation — 2004*.

<sup>25</sup>Ibid.

<sup>26</sup>National Dam Safety Program Act, P.L. 104-303, Title II §215 (33 U.S.C. §467).

Homeland Security (FEMA). ICODS is responsible for coordinating information exchange among federal dam safety agencies.<sup>27</sup>

The act also established a National Dam Safety Review Board (NDSRB) consisting of: five representatives appointed from federal agencies, five state dam safety officials, and one representative from the U.S. Society on Dams. All the representatives are appointed by the director of FEMA. This board advises the FEMA director on dam safety issues, including the allocation of grants.<sup>28</sup>

**Assistance to States.** The National Dam Safety Act establishes two state assistance programs with budget authorizations. These include:

- Training for State Inspectors. At the request of states, FEMA provides technical training to dam safety inspectors.
- Assistance to State Dam Safety Programs. States working toward or meeting minimal requirements are eligible for assistance grants. The objective of these grants is to upgrade state programs using the *ASDSO Model State Dam Safety Program* as a guide. The model state dam safety program includes a recommendation that dams be inspected at least every five years.

Allocation of state assistance grants is determined by the NDSRB and the director of FEMA. In FY2000 and FY2001, FEMA distributed \$8 million to states with existing dam safety programs to assist with buying equipment, conducting dam inspections, and developing Emergency Action Plans (EAPs).<sup>29</sup> This money is not available for rehabilitation activities.

**Reauthorization of the NDSP.** The NDSP was reauthorized in 2002 as the Dam Safety and Security Act of 2003 ( P.L. 107-310, 43 U.S.C. §467).<sup>30</sup> P.L. 107-310 made several changes to the original program, including (1) the addition of a new goal for the program that encompasses dam security; (2) a goal for states to obtain authority to require owners to improve security; (3) a limitation on the authority of ICODS to exchange information among federal entities only; (4) a clearer definition of the role of the NDSRB in relation to the states, and encouragement to maintain an

<sup>27</sup>“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 has now passed to the National Dam Safety Review Board with the enactment of the Dam Safety and Security Act of 2002.” [<http://www.fema.gov/fima/damsafe/fema.shtm>] visited on Sept. 22, 2005. Under legislation passed in the 107<sup>th</sup> Congress (P.L. 107-310), ICODS’ authority is limited to coordination among federal entities only.

<sup>28</sup>National Dam Safety Program Act, P.L. 104-303, Title II §215 (33 U.S.C. §467)

<sup>29</sup>*FEMA Report*, 2000-2001, p. 2-4.

<sup>30</sup>U.S. Congress, House Committee on Transportation and Infrastructure, Dam Safety and Security Act of 2003, H. Rept. 107-626, 107<sup>th</sup> Congress (Washington, DC: GPO, 2002). The language of the House-passed version of the legislation, H.R. 4727, was signed into law by President Bush on Dec. 2, 2002.

effective national program to enhance dam safety and protect human life and property; and (5) the addition of two new research components on (a) information technology to store, query, and distribute dam safety data related to dam performance (failures, large storm events, earthquakes, etc.), and (b) dam safety vulnerability assessments and management of sensitive dam information.

Public Law 107-310 authorized the program for an additional four years and increased the total authorized funding to \$8.6 million annually from FY2003 through FY2006. These funds are to remain available until expended. Specified funding authorizations include an increase for research from \$1.0 million to \$1.5 million for each fiscal year. The program retains the authorized levels for dam safety training at \$500,000, and increases authorized funding for staff from \$400,000 to \$600,000 for the same time period.

## Reducing Dam Failures

As the nation's dams age, they are likely to develop various deficiencies. For example, dam's foundations can show signs of seepage, cracking, and movement. To prevent failure or misoperation, these deficiencies must be identified and corrected.

### Identifying Unsafe Dams

The first step toward rectifying dam-safety issues is to identify safety deficiencies. Such deficiencies are often identified by engineers during informal inspections, or during formal inspections conducted by senior engineers. Formal inspections are generally conducted after major seismic or weather events, and on a periodic basis. As described below, the frequency and type of periodic inspections varies across agencies.

**Inspections of Federal Dams.** Each of the six federal agencies that owns dams is responsible for maintaining dam safety by performing maintenance, inspections, and rehabilitation work. The *Federal Guidelines for Dam Safety*, established in 1979 by President Carter, provides basic guidance for agencies' dam safety programs. Specifically, this document recommends that agencies formally inspect each dam at least once every five years. As shown in **Table 2**, however, some agencies require more frequent inspections. These inspections are typically funded through the agencies' operations and maintenance (O&M) budgets.

**Table 2. Agency-Owned Dams by Hazard Level and Frequency of Formal Inspections**

Agency	Number of Dams by Hazard Level			Frequency of Formal Inspections <sup>a</sup>
	Total	Significant	High	
<b>Department of Agriculture</b>				
Forest Service	326	70	29	5 years
<b>Department of Defense</b>				
Air Force	29	0	0	5 years
Army	191	24	30	5 years
Corps of Engineers	608	90	470	5 years
Navy	34	4	4	5 years
<b>Department of Interior</b>				
Bureau of Reclamation	435	24	343	3 years
Bureau of Indian Affairs	64	19	44	3 years
Bureau of Land Management	2	2	0	3 years
Fish and Wildlife Service	177	22	11	2.5 years
National Park Service	72	30	13	5 years
<b>Department of State</b>				
International Boundary Water Commission	7	1	5	5 years
<b>Tennessee Valley Authority</b>	83	15	63	5 years
<b>Department of Energy</b>	16	2	1	5 years
<i>NID Data, 2005.</i>				
a Inspection frequency obtained from agency officials in Nov. 2004.				

**Inspection of Non-Federal Dams.** Inspecting non-federal dams is generally a state responsibility, but the states are often poorly funded. According to the Association of State Dam Safety Officials, 10 state regulators are needed for every 250 dams to do the best job of carrying out their responsibilities.<sup>31</sup> However, the average number of dams per FTE is 395 and only two states (CA and FL) and one territory (PR) have the recommended number of staff.<sup>32</sup>

<sup>31</sup> Association of State Dam Safety Officials, *Model State Dam Safety Program* (1998).

<sup>32</sup> Association of State Dam Safety Officials, *State By State Statistics on Dams and State Safety Regulation — 2004*.

**Federal Involvement.** While regulating non-federal dams is generally a state responsibility, the federal government has assumed regulatory authority over certain non-federal dams. As described below, two federal agencies — the Federal Energy Regulatory Commission (FERC) and the Department of Labor’s Mine Safety and Health Administration (MSHA) — participate in inspections of certain private dams. In addition, the NRCS may become involved with inspections at the dams it constructed.

**Private Hydropower Dams.** Under the 1920 Federal Power Act, the FERC (formerly the Federal Power Commission) regulates more than 2,500 non-federal hydropower dams.<sup>33</sup> Pursuant to the *Federal Guidelines on Dam Safety* and FERC Order 122,<sup>34</sup> FERC’s regional engineers inspect each high hazard dam annually and outside consultants inspect these dams every 5 years. Low hazard dams are inspected every 3 years. The federal government recovers the costs of these and FERC’s other activities from the hydropower industry. In general, FERC’s dam safety program has received positive recognition.<sup>35</sup>

**Private Mining Dams.** Under the Mine Safety and Health Act (1977),<sup>36</sup> the Department of Labor’s Mine Safety and Health Administration, regulates 745 private dams. Under these regulations, dams used for surface mining are normally inspected every 2 years and those used for underground coal mines are inspected every 4 years.<sup>37</sup>

**NRCS Constructed Flood Control Dams.** Since 1948, the NRCS constructed more than 10,500 flood control dams. These dams were turned over to local entities under contracts that stipulate their responsibility for operation and maintenance of the dams. Therefore, the dam owners are responsible for conducting inspections pursuant to state regulations. As resources permit, however, NRCS may use funding appropriated under the Small Watershed Rehabilitation Act<sup>38</sup> to help dam owners assess specific structural or operational problems. In certain situations, NRCS will conduct an inspection as part of this assessment process.

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<sup>33</sup> *FEMA Report, 2000-2001*, p. 8-9. Of these 1,775 are included in the NID (261 Significant Hazard and 697 High Hazard Dams).

<sup>34</sup> Federal Energy Regulatory Commission, Order 122, 46 Fed. Reg. 9036 (Jan. 28, 1981), 18 C.F.R. §12.

<sup>35</sup> U.S. Dept. of Energy, Office of the Inspector General, *FERC Dam Safety Program*, DOE/IG 0486, (Oct. 2000).

<sup>36</sup> Mine Safety and Health Act, P.L. 91-173, as amended by P.L. 95-164 (30 U.S.C. §801). Available Sept. 14, 2005 at [<http://www.msha.gov/REGS/ACT/ACTTC.HTM>].

<sup>37</sup> Discussion with Kelvin Wu, Chief, Mine Waste & Geotechnical Engineering Division, Mine Safety and Health Administration, Washington, DC, on Nov. 19, 2004.

<sup>38</sup> Small Watershed Rehabilitation Act, part of the Grain Standards and Warehouse Improvement Act of 2000, P.L. 106-472, § 313.

As amended by §2505 of the 2002 Farm Bill (P.L. 107-171)<sup>39</sup> the Small Watershed Rehabilitation Program is authorized to receive both mandatory funding through the Commodity Credit Corporation and discretionary funding to be authorized through agriculture appropriations each year. Mandatory funding amounts were to start at \$45 million in FY2003 and increase by \$5 million each year through FY2007, while discretionary funding was to start at \$45 million in FY2003 and grow by \$10 million each year through FY2007. To date, congressional appropriators have prohibited mandatory funding each year, while providing a portion of the discretionary funding that had been authorized. Actual appropriations were \$29.8 million in 2003, \$29.6 million in 2004, and \$27.3 million in 2005.

## Dam Rehabilitation

### Federal Dam Rehabilitation

After dam safety deficiencies have been identified, rehabilitation activities should be undertaken. However, most federal agencies do not have funding available to immediately undertake all non-urgent repairs. Rather, they generally prioritize their rehabilitation needs — based on various forms of risk assessment — and schedule these activities in conjunction with the budget process. At some agencies, dam rehabilitation needs must compete for funding with other construction projects. Rehabilitation activities at the two major dam-owning agencies are described below.

**Department of Defense, U.S. Army Corps of Engineers.** At the Corps, most dam deficiencies are addressed through the normal operation and maintenance (O&M) procedures. However, “rehabilitation or modification of Corps’ dams for safety purposes is accomplished through the Major Rehabilitation Program and the Dam Safety Assurance Program.”<sup>40</sup> The purpose of the Major Rehabilitation Program “is to allow accomplishment of significant, costly, one-time structural rehabilitation or major replacement work (other repairs related to dam safety are accomplished under the normal O&M program)”<sup>41</sup> This program does not apply to facilities that were turned over to local interests for operation, maintenance, and major replacements after they were constructed by the Corps. The Dam Safety Assurance Program, however, applies to all dams built by the Corps regardless of current ownership. Specifically, this program “provides for modification of completed Corps dam projects which are potential safety hazards in light of current engineering standards and criteria.... This program is intended to facilitate upgrading of those project features which have design or construction deficiencies.”<sup>42</sup> The Corps schedules rehabilitation under all of these programs based on funding availability.

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<sup>39</sup> Small Watershed Rehabilitation Program, part of the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill), P.L. 107-171 § 2505.

<sup>40</sup> Army Corps of Engineers, *Dam Safety Preparedness*, EP1110-2-13 (June 1996), p. 5-1.

<sup>41</sup> *Ibid.*

<sup>42</sup> *Ibid.*

**U.S. Department of the Interior, Bureau of Reclamation.** After Reclamation’s engineers conduct dam safety inspections, through the Safety Evaluation of Existing Dams (SEED) account, any corrective action is carried out through the Initiate Safety of Dams Corrective Action program (ISCA).<sup>43</sup> Authority for Reclamation’s dam safety program originates in the Reclamation Safety of Dams Act of 1978 (P.L. 95-578) and 1984 amendments (P.L. 98-404). Through ISCA appropriations, Reclamation focuses funding on priority structures “based on an evolving identification of risks and needs.” Prior to recent legislation, Reclamation needed to submit a report to Congress for approval of modifications exceeding \$750,000. The 108<sup>th</sup> Congress increased that ceiling to \$1,250,000.<sup>44</sup> Costs incurred due to “age and normal deterioration of the structure” are considered normal operating costs and are cost-shared, with rates depending on the purposes for which the structure was constructed (project purposes). Furthermore, “modifications resulting from new hydrologic or seismic data or changes in the state of the art criteria” are cost-shared, with 15% of the costs paid by the project purposes.

## Rehabilitating Non-Federal Dams

In 2002, a Task Committee of the Association of State Dam Safety Officials estimated that \$36.2 billion is needed to rehabilitate non-federal dams and that \$10.1 billion is needed over the next 12 years for repairs to “the nation’s most critical dams.”<sup>45</sup> Responsibility to undertake this rehabilitation generally falls to dam owners.

**State Rehabilitation Funding.** While the federal government does provide some direct funding for rehabilitating non-federal dams, states and dam-owners bear the brunt of the costs. Most states have little funding to repair their own dams, let alone those dams owned by local governments, public utilities, and private entities. According to a Task Committee of the Association of State Dam Safety Officials (the Task Committee), in 2003, nine states — AZ, MA, MD, NJ, NY, OH, PA, UT, and WI — have loan or grant programs to repair unsafe dams. These programs generally focus on publicly owned dams. Additional information on these programs is provided in the Task Committee’s 2003 report and is recreated in **Table 3**.<sup>46</sup>

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<sup>43</sup>FY2001 Bureau of Reclamation Budget Justifications, p. BW-384.

<sup>44</sup>A Bill to Authorize Additional Appropriations for the Reclamation Safety of Dams Act of 1978, P.L. 108-439.

<sup>45</sup>A Task Committee of the Association of State Dam Safety Officials, *The Cost of Rehabilitating our Nation’s Dams: A Methodology, Estimate, and Proposed Funding Mechanisms* (Dec. 2002), p. 4. Available Sept. 15, 2005, at [<http://www.damsafety.org/>].

<sup>46</sup> *Ibid.*



**Table 3. State Grants for Dam Rehabilitation as of October 2003**

State	Program Type	Program Name	Source and Amount of Funding	Eligibility	Loan/Grant Amount	Term of Loan
AZ	Loan or Grant	Dam Repair	Legislature, Lien fund, Inspection fees, filing fees, principle and interest from previous loans	State engineer determines dam to be dangerous to life, non-emergency	Loan for the cost of the project, or grant for a portion of project costs	Term of loan is up to 20 years at 3-6% interest depending on the length
MD	Loan and planning assistance	Maryland Environmental Service	State Agency/ Non-profit Corporation	Counties, utilities and private groups. Need to have established service district for water supply, resource reclamation, dredging or storm water		
MA	Grants		Funding through Dept. of Environmental Management. No new appropriation as of Oct. 2003.	Local communities for repairs or removal	75% of the project, local share can be in-kind contributions	
NJ	Revolving loan fund  New grant fund for municipally owned dams	Dam Restoration and Clean Water Trust Fund	\$20M-\$5M for state high hazard dams, \$15M loans. In 2000 an additional \$9.5 <sup>a</sup> was added	Local units of governments, private owners can be co-applicants	Cost of project for loans Up to 100% for grants	Up to 20 years at 2% assessed against real estate benefitted
NY	Grants	Clean Water/Clean Air Bond Act	\$17M bonding	Municipality for dam safety projects	75% of eligible project (25% local match) \$300,000 cap per project	

State	Program Type	Program Name	Source and Amount of Funding	Eligibility	Loan/Grant Amount	Term of Loan
OH	Revolving loan fund	Ohio Water Development Authority	Revolving loan fund	Owner must under mandate from ODNR Dam Safety Loan Program-local units of government, state districts Dam Safety Linked Deposit Program- private ownership/orgs		5-25 years at lower than market rate
PA	Revolving loan fund	Pennvest	Revolving loan fund, \$2B from state general purpose funds	Projects associated with wastewater, water supply or stormwater	Up to cost of project	20-30 years at low interest
UT	Loans or grants	Utah Board of Water Resources	\$4.5 <sup>a</sup> from general revenue and 0.8 cent sales tax (created originally to deal with flood control problems)	High hazard dam owners. Mandated repairs	80-95% grant for irrigation or water supply dams, loans or grants for other owners	
WI	Grants	DNR Municipal Dam Grant Program	\$11.5M of bonding over 10 years. Currently fully subscribed	Local units of government and Lake Districts	50-50 grants up to a \$200,000 maximum	

Source: Association of State Dam Safety Officials. *The Cost of Rehabilitating Our Nation's Dams: A Methodology, Estimate and Proposed Funding Mechanism* (Dec. 2002 Revised Oct. 2003). Appendix B. Available on Sept. 23, 2005, at [<http://www.damsafetycoalition.org/files/pdf/asdsoreport.pdf>].

<sup>a</sup> Units not included in source table.

**Federal Funding.** While the federal government does help fund improvements to state dam programs, little federal funding is available for rehabilitating non-federal dams. FEMA and the NRCS are the primary sources of federal support for non-federal dam rehabilitation.

**FEMA.** As described above, the Department of Homeland Security, through FEMA, runs the National Dam Safety Program which offers training and other assistance to state dam safety programs; it generally does not provide rehabilitation funding. Through other programs, however, FEMA may provide assistance to reduce the flood damage a failure would cause.<sup>47</sup> However, this assistance generally does not include funding for rebuilding or rehabilitating dams.

**NRCS.** Many upstream flood control dams were built with assistance from the NRCS and turned over to local sponsors. Many of these dams are now nearing the end of their design life and some have significant rehabilitation needs. The NRCS has estimated that more than \$540 million is needed to rehabilitate these dams.<sup>48</sup> In 2000, Congress passed, and the President signed, legislation authorizing \$90 million in discretionary funding over 5 years to rehabilitate aging flood-water retention projects. Funds are to be allocated based on an annual ranking of requests for rehabilitation assistance.<sup>49</sup> For FY2002, Congress appropriated \$10 million for this dam rehabilitation program.

For FY2003, the administration did not include the program in its budget request. However, the Farm Security and Rural Investment Act of 2002,<sup>50</sup> which established the Small Watershed Rehabilitation Program, includes \$275 million in mandatory funding for the program through FY2007. The Small Watershed Rehabilitation Program is significant because it is the first federal initiative to dedicate funding assistance to repair non-federal dams (rather than tear down or build new dams). It uses a cost-share formula providing for 65% federal funding and 35% local funding. In the past, cost sharing has been an equal responsibility of the federal government and local sponsors for most purposes.

**Other Agencies.** In general, federal agencies such as the Corps and Reclamation do not rehabilitate non-federal dams. As described above, however, the Corps does sometimes repair structural deficiencies that resulted from their participation in the design or construction of the non-federal dam. Though quite rare, Congress has also directed federal agencies to use their dam safety appropriations to rehabilitate a non-federal dam that it did not help design or build.<sup>51</sup> However,

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<sup>47</sup> See the FEMA's Mitigation Grant Programs, available Sept. 13, 2005, at [<http://www.fema.gov/fima/mitgrant.shtm>].

<sup>48</sup> *NRCS Report*, 2000, p. 1 & 15.

<sup>49</sup> The Grain Standards and Warehouse Improvements Act of 2000, P.L. 106-472, §313.

<sup>50</sup> Small Watershed Rehabilitation Program, part of the Farm Security and Rural Investment Act, P.L. 107-171, §2505.

<sup>51</sup> See, for example, Goshen Dam, VA. Information from Pearre Charles, U.S. Army Corps of Engineers, Washington, DC, on Feb. 2, 2005.

representatives from the Corps and Reclamation have testified that they do not support such congressional direction.<sup>52</sup>

## Conclusions

As the nation's dams age and development continues in floodplains, the structural integrity of this infrastructure will become a more significant public safety issue. In the aftermath of Hurricane Katrina, it is likely that dams' planned capacity to withstand floods and other natural disasters will come under increased scrutiny. However, it is unclear to what extent there will be a widespread re-evaluation of flood and earthquake ratings at high-hazard dams. Such an evaluation could raise additional policy questions. For example, (1) what criteria should be used to determine whether current risks are acceptable; (2) if risks are not acceptable, should the dam be improved, or should other activities (e.g., changes to the design and or placement of downstream development) be undertaken; and (3) who will pay?

Regardless of whether dams were constructed to withstand an earthquake or flood of appropriate magnitude, they may have age-related deficiencies that need to be corrected to maintain current levels of safety. Therefore, it is likely that appropriation's requests for safety inspections and rehabilitation activities will continue. It should be noted, however, that there currently are no clear criteria for prioritizing dam rehabilitation funding across agencies.

It is also unclear to what extent the federal government will fund inspection and rehabilitation activities at non-federal dams. Through the National Dam Safety Program, the federal government provides training and assistance to state dam safety programs; authorization of appropriations for this program expires in FY2006. Further, Congress has authorized appropriations for rehabilitation activities at several non-federal dams. While there is likely to be an increasing demand for such assistance, there is currently no federal policy that describes the conditions under which federal funding is appropriate, nor has Congress established criteria for prioritizing funding among non-federal projects.

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<sup>52</sup> U.S. Congress, Senate Committee on Energy and Natural Resources, Subcommittee on Water and Power, *Miscellaneous Water and Hydroelectric Project Bills*, Hearing 108-271 (108<sup>th</sup> Congress), p. 28.