



Dam Safety in the United States

A Progress Report on the National Dam Safety Program
Fiscal Years 2008 through 2011



Homeland
Security

Federal Emergency Management Agency

Message from the Administrator

February 25, 2013

I am pleased to present the following report, “Dam Safety in the United States: A Progress Report on the National Dam Safety Program Fiscal Year 2008 to 2011.”

The Federal Emergency Management Agency prepared this document pursuant to 33 U.S.C. § 467h. The report describes the status of the National Dam Safety Program, including progress achieved by participating States and Federal agencies, and recommendations necessary to improve dam safety in the United States. In addition, the National Dam Safety Program report is required by Public Law 104-303, Section 215.

Pursuant to congressional requirements, this report is being provided to the following Members of Congress:

- The Honorable Barbara Boxer, Chairwoman, Environment and Public Works Committee, United States Senate
- The Honorable David Vitter, Ranking Member, Environment and Public Works Committee, United States Senate
- The Honorable Max Baucus, Chairman, Transportation and Infrastructure Subcommittee, Environment and Public Works Committee, United States Senate
- The Honorable David Vitter, Ranking Member, Transportation and Infrastructure Subcommittee, Environment and Public Works Committee, United States Senate
- The Honorable William Shuster, Chairman, Transportation and Infrastructure Committee, United States House of Representatives
- The Honorable Nick J. Rahall II, Ranking Member, Transportation and Infrastructure Committee, United States House of Representatives
- The Honorable Jeff Denham, Chairman, Economic Development, Public Buildings, and Emergency Management Subcommittee Transportation and Infrastructure Committee, United States House of Representatives
- The Honorable Eleanor Holmes Norton, Ranking Member, Economic Development, Public Buildings, and Emergency Management Subcommittee, Transportation and Infrastructure Committee, United States House of Representatives



Inquiries relating to this report may be directed to me at (202) 646-3900, or to the Department's Deputy Chief Financial Officer, Peggy Sherry, at (202) 447-5751.

Sincerely,

A handwritten signature in blue ink, appearing to read 'W. Craig Fugate', with a long horizontal flourish extending to the right.

W. Craig Fugate
FEMA Administrator

Preface

Water is one of the most powerful natural forces to shape the American landscape and one of our most precious resources. Over the years, dams and other water control structures have been built to manage water for societal benefit. Collectively, American rivers are the most closely controlled hydrological systems of their size in the world.

Today, dams are a vital part of the American infrastructure,¹ providing economic, environmental, and social benefits, including hydroelectric power, river navigation, water supply, wildlife habitat, waste management, flood control, and recreation. 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 and significant property and environmental damage.

For more than 30 years, reducing the risk of dam failure has been the driving force of the National Dam Safety Program, and central to the Program mission of ensuring that the public and property owners downstream are informed of the risk from dam failure.

The following vision and mission serve as the cornerstone for all of the activities of the National Dam Safety Program:

The vision is: A future in which the public safety, economic strength, environment, and national security of the United States are not threatened by the risk from dam failure.

The mission 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 that brings together the expertise and resources of the Federal and non-Federal communities in achieving national dam safety hazard reduction.

The objectives of the National Dam Safety Program, which are set forth in the Dam Safety Act of 2006, help to realize the Program vision and mission. These objectives 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;

¹ In 2003, the White House issued Homeland Security Presidential Directive-7, *Critical Infrastructure Identification, Prioritization, and Protection*, which identified 17 critical infrastructure/key resource sectors, and assigned leadership for cooperation and integration of efforts to Sector Specific Agencies (SSA). The Dam Sector is one of 10 sectors assigned to DHS as the SSA.

- 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.

This report to Congress describes the achievements of the States, the Federal agencies, and their partners in Fiscal Year (FY) 2008 through FY 2011 in meeting the vision, mission, and objectives of the National Dam Safety Program. The final chapter of this report includes strategies for strengthening the Program.



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Executive Summary

This report on the National Dam Safety Program (NDSP) for Fiscal Year (FY) 2008 through FY 2011 is submitted to Congress by the Federal Emergency Management Agency (FEMA), as required by the Dam Safety Act of 2006 (Public Law 109-460).

Public Law 109-460, which reauthorized the NDSP through FY 2011, continues all of the elements of the program established by the 1996 Act and the 2002 amendment that have been serving to increase the safety of the Nation's dams. This Program includes assistance to the States for the improvement of State dam safety programs; training for State dam safety staff and inspectors; research; funding to the U.S. Army Corps of Engineers for maintaining and updating the National Inventory of Dams (NID); and funding to FEMA to administer the Program and provide leadership to the Interagency Committee on Dam Safety (ICODS) and the National Dam Safety Review Board (Review Board). The Review Board advises the FEMA Administrator on national policy issues affecting dam safety.

Since the NDSP was first established in 1996, improvements in the safety of many of our Nation's dams have resulted in part from Program funding for State assistance, training, and research. The state of the dam infrastructure continues to be a significant concern. The American Society of Civil Engineers (ASCE), in its most recent report card, gives dams a grade of "D" (*2009 ASCE Report Card for America's Infrastructure, January 2009*).

According to the *2009 Report Card*, the number of deficient dams² in the United States has risen to more than 4,000, including 1,819 high-hazard potential dams. In 2009, the Association of State Dam Safety Officials (ASDSO) estimated that it would cost approximately \$50 billion to repair the Nation's dams and an additional \$12 billion over 10 years to eliminate the existing backlog of deficient dams.

Data for this reporting period indicate that the States continue to make progress in addressing the challenges posed to their dam safety programs. The National Dam Safety Program Activities chapter in this report presents data on the identification of deficient dams, implementation of emergency action plans for high-hazard potential dams, and dam inspections. The data reflect what is occurring in State dam safety programs across the United States, despite declining resources, to address an increasingly aging and hazardous dam infrastructure. State dam safety programs are improving their ability to meet these challenges. This chapter also presents highlights of Program activities in the areas of research, training, and emergency action planning.

Although the Federal Government owns or regulates only about 6.5 percent of the dams in the United States, many of these dams are significant in terms of size, function, benefit to the public, and their hazard potential. The Federal Agency Programs chapter of this report describes the

² The term "deficient" dam means that (a) the dam has a likely probability of failure under loading conditions that may realistically occur or (b) the dam requires immediate or emergency remedial action for problem resolution.

progress of Federal agencies in implementing the *Federal Guidelines for Dam Safety* and issues that the agencies continue to face in the operation and maintenance of their dams.

The Dam Safety Act of 2006 requires the FEMA Administrator to submit a report to Congress that (1) describes the status of the National Dam Safety Program; (2) describes the progress achieved by Federal agencies during the two preceding fiscal years in implementing the Federal Guidelines for Dam Safety; (3) describes the progress achieved in dam safety by States participating in the Program; and (4) includes recommendations for legislative and other action that the Administrator considers necessary.

The Focus on the Future chapter of this report includes strategies for the Program to realize the long-term goal of keeping the American public safe from dam failure.

This report describes the progress of the NDSP in FY 2008–2011. It is important to note that there continue to be accomplishments across all Program elements, including State assistance, research, training, and the alignment of the Program within the emergency management and resilience frameworks. For example, the States continue to make progress in emergency action planning for their high-hazard potential dams and in inspecting those dams. On the research component, FEMA convened a Summit and a Workshop to identify emerging priorities in resilience, emergency management, and dam infrastructure. As part of this new research focus, the National Research Council is examining the policy, economic, and human behavioral drivers that promote or inhibit the expansion of dam and levee hazard mitigation and safety programs in terms of community resilience. FEMA is now developing a business model to carry out its new research role. To address the training needs of the 21st century, FEMA also convened a Training Summit to gather stakeholder input for a National Dam Safety Training Plan. All of the elements and initiatives discussed above must work together and in concert with other affiliated programs and partners to be effective.

In 2011, FEMA funded an evaluation of all the NDSP components. The recommendations from the evaluation will be implemented through a new 5-year Strategic Plan that will guide the long-term direction of the Program under FEMA's leadership.

I. Introduction

This report on the National Dam Safety Program (NDSP) for Fiscal Year (FY) 2008 through 2011 is being submitted to Congress by the Federal Emergency Management Agency (FEMA), as required by the Dam Safety Act of 2006 (Public Law 109-460). The Dam Safety Act of 2006 states that the FEMA Administrator will submit a report that describes the status of the National Dam Safety Program, the progress achieved by the Federal agencies during the two preceding fiscal years in implementing the *Federal Guidelines for Dam Safety*, and the progress achieved by the States participating in the Program. The report includes recommendations for legislative and other action that the Administrator considers necessary.

Public Law 109-460 reauthorized the funding limits for the NDSP through FY 2011 and continued all of the components established by the 1996 Act and the 2002 amendment. These components include assistance to the States for improvement of State dam safety programs, training, research, funding to the U.S. Army Corps of Engineers (Corps) for maintaining and updating the National Inventory of Dams (NID), and funding to FEMA for leadership and management of the Program.

This report highlights Program achievements based in large part on data submitted by the States and Federal agencies. The most noteworthy data during the reporting years is the absence of fatalities from dam failures or incidents.³

According to statistics from the Association of State Dam Safety Officials (ASDSO), there were 28 dam failures in the United States from 1874 to 1979, resulting in 3,424 deaths. From 1979, the year the National Dam Safety Program was established, through the end of 2011, dam failures across the United States resulted in more than 30 fatalities, including 7 people killed in the March 2006 failure of the Kaloko Reservoir on the island of Kauai, Hawaii. Although there were no fatalities from dam failures during this reporting period, economic and environmental clean-up costs resulting from dam failures and incidents had significant impacts on Federal and State Governments and affected communities.

For example, the December 2008 coal fly ash spill at the Tennessee Valley Authority's (TVA's) Kingston Plant, which was caused by the breach of a containment dike, rendered three homes uninhabitable. TVA estimates that the cost of remediating the Kingston ash spill will be between \$1.1 billion and \$1.2 billion. TVA completed the removal of the time-critical ash from the river during the third quarter of 2010, and the final removal of non-time-critical ash will be completed in the first quarter of 2015.

On July 24, 2010, the Lake Delhi Dam in eastern Iowa failed, discharging up to 500,000 gallons per second of water into the Maquoketa River and forcing the evacuation of hundreds of homes

³ Dam failure is defined by the *Federal Guidelines for Dam Safety* (FEMA 148) as catastrophic failure characterized by the sudden, rapid, and uncontrolled release of impounded water or the likelihood of such an uncontrolled release. Dam incidents are events affecting the operational and structural performance of dams and public safety.

and vacation cabins. In Monticello, Iowa, 50 homes and 20 businesses suffered severe flood damage. The cost to reconstruct Lake Delhi Dam is estimated at \$12 million.

In August 2011, the flooding from Hurricane Irene also caused a number of dam failures in the Northeast and Mid-Atlantic States. There were no catastrophic failures, but many dams were overtopped and badly damaged.

Because the dam infrastructure in the United States is aging, dam failures may increase. For this reason, the inspection of dams and the implementation and exercise of Emergency Action Plans (EAPs) will continue to be critically important for helping to reduce the risk from dam failure. Data for this reporting period indicate increases in both the number of EAPs and inspections of high-hazard potential dams, two measures for which FEMA and the National Dam Safety Review Board identified State-based performance in 2006. Data on a third measure, the identification of high-hazard potential dams requiring structural remediation, is now being tracked. This condition assessment data will serve as the basis for a new performance measure for all States and will provide valuable benchmark information for policymakers on the resources needed to rehabilitate and maintain the dam infrastructure.

Outreach and public awareness was a new initiative in FY 2009 for the State assistance component of the NDSP. FEMA strongly believes that the most critical message in dam safety today is that the lives of Americans are at risk, on an ever-increasing basis, from aging, unsafe dams, and there are insufficient safeguards in place to protect them from dam failure. To address this need, FEMA is requiring States participating in the Program to allocate a portion of their State assistance funds to outreach and public awareness on the risk presented by dams to the downstream public and critical facilities. To complement individual State efforts in this area, FEMA and its partners completed pilot projects in Missouri, North Carolina, and Texas to identify the most effective outreach and marketing strategies and tools for promoting EAPs. FEMA, with guidance from the Review Board and the Work Group on Emergency Action Planning, is now in the process of adapting and expanding the project for national implementation.

FEMA is also taking a proactive approach to training and research. In FY 2010, FEMA convened a Research Summit and a Research Workshop to develop a new 5-year Strategic Plan for dam safety research. FEMA goals for this area are to expand the research program from its focus on Federal engineering research and to implement a better cross-walk between research products generated and training offered to stakeholders. In FY 2011, FEMA convened a Training Summit to gather stakeholder input for a new National Dam Safety Training Plan. The outcome will be a balanced, cost-effective, and forward-looking training program for diverse audiences, including engineers; dam inspectors; dam operators and owners; Federal, State, and local regulators and administrative staff; policy makers; business owners; homeowner groups; State and local emergency managers; and State and local emergency responders.

The National Dam Safety Program is a relatively small program, which has helped to encourage appropriate actions that address and reduce the risks associated with the Nation's more than 84,000 dams. Through State assistance, training, research, data collection, and other activities,

the Program provides a much needed impetus for the ongoing protection of people, property, and the environment from dam failure. The final chapter of the report discusses strategies to help realize the vision, mission, and objectives for the Program in FY 2012 and beyond.

II. The National Dam Safety Program

A. Overview and History

For more than 30 years, reducing the risk of dam failures has been the driving force of the NDSP. In the 1970s, a series of catastrophic dam failures set the stage for the creation 20 years later of a national program to ensure the safety of America's dams. 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 more than 3,000 were left homeless. On June 5, 1976, Teton Dam, a 123-meter-high earth fill dam on the Teton River in Idaho, failed, causing \$1 billion in damage and leaving 11 dead. More than 4,000 homes and an equal number of farm buildings were destroyed as a result of the Teton Dam failure. In November 1977, Kelly Barnes Dam in Georgia failed, killing 39 people, most of them college students.

In response to the Buffalo Creek failure in 1972, Congress enacted Public Law 92-367, which authorized the Corps to inventory and inspect non-Federal dams. In November 1977, this time in response to the Kelly Barnes Dam failure, President Jimmy Carter directed the Corps, in cooperation with the States, to proceed under the authority of Public Law 92-367 to inspect non-Federal dams classified as high-hazard potential because of the downstream population at risk. Less than 2 years later, Executive Order 12148 established FEMA, and provided that FEMA would coordinate all efforts in dam safety.

The next Federal legislation to address dam safety was the Water Resources Act of 1986. Title XII of this legislation authorized a program of State assistance, the establishment of a National Dam Safety Review Board (Review Board), research and training programs, and funds to maintain and update a NID. Despite this recognition, there was no legislatively mandated National Dam Safety Program until Congress enacted Public Law 104-303 in 1996.

The passage of the 1996 Act reflected the culmination of years of collaborative effort on the part of many in the dam safety community. Since then, Congress has amended the Program's authorizing statute twice, most recently in 2006 (Public Law 109-460).

B. The Dam Safety Act of 2006

On December 22, 2006, the Dam Safety Act of 2006 (Public Law 109-460) was signed into law. Public Law 109-460 reauthorized the funding limits for the National Dam Safety Program through FY 2011.

The purpose of the National Dam Safety Program 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."

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; and
- Develop technical assistance materials for Federal and State dam safety programs; 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.

Under the Dam Safety Act of 2006, FEMA is authorized to carry out a number of initiatives. These initiatives are summarized below:

- Continue the National Dam Safety Review Board to monitor the safety of dams in the United States, to monitor State implementation of the National Dam Safety Program, and to advise FEMA;
- Coordinate Federal efforts in dam safety by chairing the Interagency Committee on Dam Safety (ICODS);
- Transfer knowledge and technical information among the Federal and State sectors;
- Provide for the education of 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 State assistance program;
- Provide training for State dam safety staff and inspectors;
- Establish a program of technical and archival research to develop and support:
 - 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
- Guide the formulation of effective public policy and advance improvements in dam safety engineering, security, and management.

C. Leadership of the National Dam Safety Program

Dam safety is not solely a Federal, State, or local issue. The safety 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 lead and coordinate Federal, State, and local efforts to protect citizens from dam failures. FEMA, as Chair, administers the NDSP and provides leadership of the Review Board and ICODS.

The mission of FEMA is “to support our citizens and first responders to ensure that as a nation we work together to build, sustain, and improve our capability to prepare for, protect against, respond to, recover from, and mitigate all hazards.” Four initiatives help FEMA to carry out this mission:

- Foster a Whole Community Approach to Emergency Management Nationally
- Build the Nation’s Capacity to Stabilize and Recover from a Catastrophic Event
- Build Unity of Effort and Common Strategic Understanding Among the Emergency Management Team
- Enhance FEMA’s Ability to Learn and Innovate as an Organization

The leadership and administration of the NDSP at FEMA is the responsibility of the Federal Insurance and Mitigation Administration (FIMA), a national leader in the effort to help communities address and reduce their disaster risks. FIMA, which has the lead responsibility for implementing FEMA’s mitigation and insurance mission, is organized into three primary business lines: Risk Analysis, Risk Reduction, and Risk Insurance. After disasters, FIMA also provides critical services and expert personnel during response and recovery activities. The NDSP resides in the FIMA Risk Analysis Division. Under the leadership of FEMA, the States, Federal agencies, professional organizations, and others work in collaboration to encourage individual and community responsibility for dam safety.

During this reporting period, FEMA worked with its partners on a number of new initiatives designed to evaluate the progress achieved in dam safety since the establishment of the NDSP, identify lessons learned and recommendations for improvement, and implement a national Strategic Plan for moving forward through FY 2016. FEMA also funded a study with the National Research Council to examine the policy, economic, and human behavioral drivers that promote or inhibit the expansion of dam and levee hazard mitigation and safety programs to promote community resilience. Conclusions will be made on tools, information, or guidelines that can broaden the scope of dam and levee safety to include community-level mitigation, preparation, response, and recovery from dam failures. (A report from this study, entitled, *Dam and Levee Safety and Community Resilience: A Vision for Future Practice*, was released in the summer of 2012.)

FEMA funded an evaluation of all components of the NDSP. The evaluation team consisted of the Water Policy Collaborative, Department of Civil and Environmental Engineering, Clark

School of Engineering, University of Maryland. The recommendations from the evaluation team, which address a cross-section of Program areas from training and research to leadership and administration, are now being implemented to help guide the long-term direction of the Program under FEMA's leadership.

As the evaluation of the NDSP was being completed, FEMA, the Review Board, and ICODS began work on a new Strategic Plan to address the recommendations from the Program evaluation and identify emerging priorities. The Strategic Plan for FY 2012 through 2016 presents a partnership-based approach for reducing the risk and consequences from dam failures for the next 5 years, and is closely aligned with FEMA's priorities and initiatives to help its State and local partners build, sustain, and improve community resilience to all hazards. The Strategic Plan presents activities designed to meet the strategic goals for the Program, ranging from the performance of basic and applied research, to developing cost-effective risk reduction measures, to promoting the implementation of these measures in practice. Attaining these goals should increase community and regional resilience in the event of dam failures, improve life safety, reduce economic losses, and minimize security disruptions.

Congress directed FEMA to establish the Review Board under Public Law 104-303, as amended in Public Law 107-310 and Public Law 109-460 to (1) monitor the safety of dams in the United States; (2) monitor State implementation of the National Dam Safety Program requirements; and (3) advise the administrator on national dam safety policy.

The membership of the Review Board includes the representative from FEMA selected by the FEMA Administrator to serve as Chair of the Review Board; representatives from four Federal agencies that serve on ICODS; five members selected by the Administrator of FEMA from among State dam safety officials; and one member selected by the Administrator of FEMA to represent the private sector. Members are selected based on their recognized professional level of dam safety experience.

FEMA established four standing Work Groups to assist the Review Board in performing its duties and achieving its goals. These Work Groups consist of the Dam Safety Research Work Group, the Dam Safety Training Work Group, the Work Group on the NID, and the Work Group on Emergency Action Planning for Dams. The activities of the standing Work Groups are described in the National Dam Safety Program Activities chapter.

During this reporting period, FEMA established a number of ad hoc task groups and steering committees to address specific projects and requirements, such as the refinement of reporting criteria for the State assistance program, monitoring the inundation mapping and consequence assessment research projects, updating the *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, FEMA 64, and development of the new Strategic Plan for the NDSP for FY 2012 to 2016. In addition, the Review Board developed policy statements and adopted resolutions to advise FEMA on national policy on dam safety in the United States.

ICODS, which was established in October 1979 and meets quarterly, encourages the establishment and maintenance of effective Federal programs, policies, and guidelines to enhance

dam safety for the protection of human life and property, and serves as the permanent forum for the coordination of Federal activities in dam safety. ICODS was formally established by Public Law 104-303 in 1996 and is composed of members from all the Federal agencies that build, own, operate, or regulate dams.

The National Dam Safety ICODS agencies are:

- U.S. Department of Agriculture
- Department of Defense
- Department of Energy
- Department of the Interior
- Department of Labor, Mine Safety and Health Administration
- Federal Energy Regulatory Commission
- Department of State, International Boundary and Water Commission
- Nuclear Regulatory Commission
- Tennessee Valley Authority

ICODS accomplishes its mission and purpose by serving as the permanent forum for the following activities:

- Coordination and information exchange among Federal agencies on dam safety issues, including implementation of the *Federal Guidelines for Dam Safety*;
- Achievement of the objectives related to the Federal element, as outlined in Section 8 of the Dam Safety Act of 2006; and
- Collaboration with the Review Board to ensure consistency and support between the Federal element and non-Federal element to accomplish a united National Dam Safety Program.

In FY 2008 through 2011, ICODS established three subcommittees to prepare new Federal dam safety guidelines. The ICODS Subcommittee on Piping and Internal Erosion and the ICODS Subcommittee on Structural Stability of Concrete Dams are completing their final approved guidelines, and the ICODS Subcommittee on Extreme Hydrologic Events is scheduled to complete its guidelines in FY 2012.

In FY 2011, ICODS established a Task Group to consider the need for a formal procedure for evaluating an ICODS member agency's compliance with the *Federal Guidelines for Dam Safety*. The result of this Task Group's work was an ICODS resolution encouraging the evaluation of agency dam safety programs at least once every 10 years. In FY 2011, ICODS also established a

Task Group to determine the need for updating the *Federal Guidelines for Dam Safety* and a Task Group to address the risk posed by private dams on Federal lands. The work of both of these Task Groups will continue into FY 2012.

D. Partners and Stakeholders

A number of nongovernmental organizations, companies, universities, and individuals are involved in advancing the dam safety mission. Engineering consulting firms design, oversee construction and rehabilitation, and at times inspect dams for owners or regulators. Those in academia conduct research and teach the next generation of dam safety engineers. All are active stakeholders in the dam safety community.

Some of the many national and international organizations with interests in dam safety are:

- American Consulting Engineers Council
- American Public Works Association
- American Rivers
- American Society of Civil Engineers
- Associated General Contractors of America, Inc.
- Association of State Dam Safety Officials
- Association of State Floodplain Managers
- Centre of Energy Advancements through Technological Innovation
- Earthquake Engineering Research Institute
- Electric Power Research Institute
- International Association of Emergency Managers
- National Association of Counties
- National Conference of State Legislatures
- National Emergency Management Association
- Natural Hazards Center
- National Hydropower Association
- National Society of Professional Engineers
- National Watershed Coalition
- Portland Cement Association
- United States Society on Dams

E. Related Programs and Initiatives

As the lead agency for the NDSP, FEMA has worked for years with many other Federal agencies, the States, and private industry on related programs and initiatives to further advance dam safety in the United States. FEMA's continuing mission within the Department of

Homeland Security (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.

Homeland Security Presidential Directive 7, *Critical Infrastructure Identification, Prioritization, and Protection* (2003), established a framework to identify, prioritize, and protect the Nation's Critical Infrastructure and Key Resources (CIKR). The directive identified a number of CIKR sectors, one of which is the Dams Sector, and assigned responsibility for these sectors to Federal Sector-Specific Agencies (SSAs). The Office of Infrastructure Protection (IP) within DHS serves as the SSA for the Dams Sector.

The Dams SSA actively collaborates with sector stakeholders (including Federal, State, regional, local, Tribal, territorial, and private sector partners) to identify and implement programs that enhance the protection and resilience of dams across the Nation. This collaboration occurs under the auspices of the Critical Infrastructure Partnership Advisory Council (CIPAC). The CIPAC framework provides a forum that allows Government and private sector partners to conduct effective information sharing and coordinate a broad spectrum of infrastructure protection activities across all sectors. As part of the CIPAC framework, the Dams Sector Coordinating Council and Government Coordinating Council constitute a focal point for public-private coordination of infrastructure protection efforts for dams and related facilities.

Protective programs and resilience strategies encompass a wide spectrum of efforts, including implementing active or passive countermeasures and improving security protocols, hardening or retrofitting facilities to improve their performance under extreme loadings, implementing cybersecurity measures, building operational redundancy, implementing back-up systems to minimize disruptions, implementing consequence-mitigation programs, conducting exercises, enhancing business continuity planning, and designing and planning multi-scenario restoration and recovery procedures. Effective information exchange among owners, regulators, and their associated communities can also contribute to enhancing the protection and resilience of the Dams Sector.

The collaborative partnership among government and non-government entities across the Dams Sector has resulted in the development of a variety of tools and products focused on improving protection and enhancing resilience. These include a method for identifying the Nation's most critical dams, a series of regional exercises, and a number of training and outreach efforts. For example, sector partners collaborated to develop a Consequence-Based Top-Screen (CTS) methodology that systematically assembles consistent data to identify and prioritize those assets based on human impacts, economic consequences, and disruption of critical functions, e.g., water delivery, navigation, electricity production. The CTS methodology is implemented through a Web-based questionnaire that allows an efficient screening to identify potentially high-consequence assets.

The Dams Sector Exercise Series (DSES) is an effective mechanism for developing resilience strategies at the regional level. The overarching goal of this effort is to develop strategies for improving regional protection and resilience that are directly applicable to the initial system under consideration, and are "scalable" in the sense that the resulting processes and solutions may be extrapolated to larger regions with similar characteristics.

The first series of these exercises took place in 2008 (DSES-08), with the overall goal of testing interoperability and communications protocols among Government and non-Government entities facing a catastrophic event involving multiple dams located in the same river basin in Missouri. In 2009, the Dams SSA, in collaboration with the Corps, the Pacific Northwest Economic Region, and other Pacific Northwest region stakeholders, conducted another series of exercises (DSES-09) focused on a major flood event affecting the Tri-Cities area (Kennewick, Pasco, and Richland) in Washington. The DSES-10 effort took advantage of the multiple activities, capabilities, and proactive engagement demonstrated by Green River Valley stakeholders as a result of the operational conditions at Howard Hanson Dam, also in Washington. This dam, owned and operated by the Corps, provides flood risk reduction and water storage on the Green River.

To ensure that all dam stakeholders have access to information related to protective programs, sector partners have collaborated with DHS to develop a series of handbooks and guides focused on security awareness, protective measures, and crisis management. These handbooks also serve as the basis for the development of associated Web-based training modules. Sector partners have also supplied templates, models, and outlines of their respective plans for site physical security, pandemics, computer incident response, recovery, exercises, and continuity of operations to assist other sector partners in developing resilience strategies. The reference documents and training resources are accessible through the Homeland Security Information Network-Critical Sector Dams Portal.

Within their agency critical infrastructure protection and resilience research programs, the DHS Science and Technology Directorate, the U.S. Bureau of Reclamation, and the Corps have coordinated their research investments and shared results to better understand blast effects on dam components (such as embankment and concrete dams, reservoir control gates, lock chambers and gates, intake and outlet structures, and hydropower plants). The agencies funded efforts to conduct physical blast testing of dams, gates, locks, and levees; improve numerical modeling capabilities; establish standoff requirements for water-side approaches to dam complexes; and develop designs of innovative blast mitigation measures to protect dams, gates, levees, and related infrastructure.

The collaborative approach required for dam safety and dam risk management is aligned with Presidential Policy Directive (PPD)-8: National Preparedness, March 2011. Under PPD-8, a National Preparedness System was established that provides the approach, resources, and tools for meeting the National Preparedness Goal: A secure and resilient Nation with the capabilities required across the whole community to prevent, protect against, mitigate, respond to, and recover from the threats and hazards that pose the greatest risk.

The National Preparedness System has six main components for improving our preparedness:

- Identifying and assessing risks;
- Estimating capability requirements;
- Building or sustaining capabilities;

- Developing and implementing plans to deliver those capabilities;
- Validating and monitoring progress made toward achieving the National Preparedness Goal; and
- Reviewing and updating efforts to promote continuous improvement.

To support the dam safety community in better identifying and assessing dam failure risks, the DHS Science and Technology Directorate (S&T) is funding the development of new and powerful software for rapidly and accurately visualizing a flood, addressing consequences, and training emergency responders. To develop the new software, S&T worked with experts from IP and the University of Mississippi to better understand what dam and levee owners and operators need from the software.

The key component of the project is DSS-WISE™ (Decision Support System for Water Infrastructural Security) and the underlying flood simulator, CCHE2D-FLOOD™ developed by National Center for Computational Hydroscience and Engineering of the University of Mississippi. The flood simulator can replicate flooding caused by any cataclysm less fateful than The Great Deluge, including a breached levee, a failed dam, a surging tide, and a tsunami. The second critical project component is the Dams Sector Analysis Tool (DSAT), a powerful Web-based application developed by the Dams SSA in collaboration with the Corps Headquarters' Office of Homeland Security. DSAT is a one-stop shop where dam owners and operators have secure access to analytical capabilities within a graphical environment. Dam owners and operators use algorithms in DSAT to identify and prioritize the most critical dams in their portfolios. DSAT also incorporates a geospatial viewer with powerful query capabilities and access to real-time information.

Using DSAT, a dam owner or operator can prepare the input data required for the flood simulation using DSS-WISE™. For example, to characterize a potential dam failure scenario, operators define the reservoir, identify the main dam, note structures using satellite imagery, and specify the type failure to be considered: a “sudden and complete failure” or a “gradual and partial breaching.” DSAT draws data from the NID, bundles the data into a data file, and emails it to a dedicated server where the simulation is run. When the simulation ends, the server automatically notifies the user, who can then upload the results on DSAT where they are rendered onto a map

Streamflow Information

Information on the flow in rivers and streams is a vital national asset that safeguards life and property and helps ensure adequate water resources for a healthy economy. The U.S. Geological Survey (USGS) operates and maintains the largest stream gage network in the world with about 8,000 stream gages active. Historic streamflow information is also available at about 20,000 locations where streamflow monitoring has been discontinued. Nearly all of the existing stream gages use real-time telemetry that records and transmits streamflow information electronically, so current information is readily available on the Internet (data are typically recorded at 15- to 60-minute intervals and transmitted every 1 to 4 hours). USGS streamflow information is used in many ways for dam safety and risk assessments, including (1) real-time operation and

management of water flowing in and out of reservoirs; (2) reservoir designs and operations based on long-term conditions; (3) flood forecasting by the National Weather Service and others; and (4) flood plain delineation by FEMA and others.

USGS streamflow applications and mapping are equally important in dam safety and risk assessment. The USGS StreamStats online program, now available for 27 States, estimates and maps streamflow, including estimated flood flows, and watershed characteristics for gaged and ungaged streams. The USGS manages the WaterWatch Web page, which provides real-time information for the entire Nation for conditions over a 30-year history. A separate map highlights stream gage locations that are currently approaching or above flood stage. Most recently, the USGS developed systems, such as the WaterAlert service, for accessing real-time information, including flood stage warnings, from email and hand-head devices. The USGS stream gage network is funded through partnerships with more than 850 Federal, State, regional, local, and tribal agencies.

Dam Removal

Dam removal has been increasing as a result of concerns about safety, maintenance costs, and river restoration. Information is lacking, however, on river and ecological responses to abrupt changes in flow regime and sediment following dam removal. USGS is helping to fill in the gaps, such as in the Pacific Northwest, which has experienced the removal of Elwha Dam and Glines Canyon Dam on the Elwha River. The USGS is monitoring sediment transport downstream of dams and surveying river cross-sections at select locations. USGS scientists are also monitoring the associated estuarine environments and fish populations to assess effects from dam removal. Such studies are needed to fully understand flooding hazards and minimize river ecosystem disruptions caused by dam removal or a dam failure.

Climate Change

Anticipation of adequate water supplies and runoff to reservoirs is increasingly difficult because of climate variability and changes to historic winter precipitation and snow packs. In a future of a warming climate, the past may not be a good predictor of the future. For example, USGS studies on climate change and how it will affect runoff in Pacific Northwest rivers and other northern areas show a scenario of increased runoff in the winter and smaller snow packs in the spring. Management of dams on reservoirs will require a new approach to the timing of storage and releases to safely manage the system for flooding and water supply.

Flood Inundation Mapping

Adequate information on the construction of dams or potential downstream hazards in the event of a dam breach is not available for many U.S. reservoirs. In 2009, the U.S. Forest Service (USFS) identified the need for reconnaissance-level dam-breach assessments for four reservoirs within the Black Hills National Forest with the potential to flood downstream structures. Flood hydrology and dam-breach hydraulic analyses for selected reservoirs were conducted by USGS in cooperation with the USFS to estimate the areal extent of downstream inundation. Three high-flow breach scenarios were considered for cases when the dam is in place (overtopped) and when a dam break (failure) occurs: the 100-year recurrence 24-hour precipitation, 500-year recurrence

peak flow, and the probable maximum precipitation. Inundation maps were developed that show the estimated extent of downstream floodwater from simulated scenarios. Simulation results were used to determine the hazard classification of a dam break (high-, significant-, or low-), based primarily on the potential for loss of life or property damage resulting from downstream inundation from the flood surge. The resulting flood-inundation maps can provide valuable information to city officials, emergency managers, and local residents for planning the emergency response if a dam breach occurs.

Paleofloods

A recent paleoflood study completed in South Dakota and Oregon, documenting the frequency and magnitude of rare floods, has obvious applicability for dam safety issues. Such studies provide information on prehistoric floods and can give an indication of possible major flooding to assess dam safety and risks.

FEMA's Risk Analysis Activities

FEMA manages several risk analysis programs, including Flood Hazard Mapping, Multi-Hazard Mitigation Planning, and Hazards United States Multi-Hazard (Hazus), which assess the impact of natural hazards and lead to effective strategies for reducing risk. These programs support the DHS objective to “strengthen nationwide preparedness and mitigation against natural disasters.” In FY 2009, FEMA established the Risk Mapping, Assessment, and Planning (Risk MAP) Program. Risk MAP integrates and aligns the individual risk analysis programs into a more effective unified strategy. The vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property.

The work being performed under Risk MAP is grounded in current authorities provided in the National Flood Insurance Reform Act of 1994; the National Dam Safety Program, as expressed in Section 215 of the Water Resources Development Act of 1996 (Public Law 104-303); and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended.

In the Nation's comprehensive emergency management framework, the analysis and awareness of natural hazard risk continues to pose challenges. For communities to make informed risk management decisions and take action to mitigate risk, a consistent risk-based approach to assessing potential vulnerability and losses and tools to communicate the message are needed. Risk MAP aims to close this gap. By analyzing and depicting flood risk, communities and the American public can better understand their risk and make informed decisions to reduce vulnerability. Risk MAP also works toward achieving targets stated in the National Preparedness Goal developed under PPD-8.

Ultimately, through collaboration with State, local, and tribal entities, Risk MAP will reduce losses of life and property through effective local mitigation activities enabled by quality flood hazard data, risk assessments, and mitigation planning. Risk MAP establishes an integrated flood risk management approach that leverages and enhances the existing data from Flood Map Modernization. Risk MAP will provide an integrated Web-accessible national assessment of flooding risks based on quality flood hazard data. This information will enable communities to develop mitigation plans and make informed risk management decisions.

FEMA continues to collaborate with local, State, regional, tribal, national, and other Federal partners in communicating these objectives and implementing Risk MAP. Because FEMA's efforts extend throughout the Nation, implementing Risk MAP helps to maintain the engineering capability in the State and private sectors, sustaining jobs and stimulating the economy.

F. Tracking Data and Performance

Information needs for dam safety extend from those in Congress who set national priorities and allocate fiscal resources to the dam owner and engineer involved in inspections, operations and maintenance, and other day-to-day activities of maintaining safe structures. A primary objective of FEMA in its leadership of the NDSP is to identify, develop, and enhance technology-based tools that can help dam owners/operators, educate the public, and assist decisionmakers.

National Inventory of Dams

Congress first authorized the Corps to inventory dams in the United States with the National Dam Inspection Act of 1972. The NID was first published in 1975, with a few updates as resources permitted over the next 10 years. The Water Resources Development Act of 1986 authorized the Corps to maintain and periodically publish an updated NID, with reauthorization and a dedicated funding source provided under the Water Resources Development Act of 1996. The Corps also began close collaboration with FEMA and State regulatory offices to obtain more accurate and complete information. The National Dam Safety and Security Act of 2002 and the Dam Safety Act of 2006 both reauthorized the NDSP and included the maintenance and update of the NID by the Corps.

The NID consists of dams meeting at least one of the following criteria:

- High hazard classification, which means loss of one human life is likely if the dam fails;
- Significant hazard classification, which is the possible loss of human life and likely significant property or environmental destruction;
- Equal or exceed 25 feet in height and exceed 15 acre-feet in storage; or
- Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

The goal of the NID is to include all dams in the United States that meet these criteria. Data collection has been focused on the most reliable data sources, which are the Federal and State Government dam construction and regulation offices.

In most cases, dams meeting the NID criteria are regulated (construction permit, inspection, and/or enforcement) by Federal or State agencies, which have basic information on the dams within their jurisdiction. The Corps conducts periodic collection of dam characteristics from 49 States (Alabama currently has no dam safety legislation or formal dam safety program), Puerto Rico, and 18 Federal agencies.

Database management software is used by most State agencies to compile and export update information for the NID. With source agencies using such software, the Corps receives data that

can be parsed and has the proper NID codes. The Corps can then resolve duplicative and conflicting data from the 68 data sources to obtain the more complete, accurate, and updated NID. Today, the NID database consists of 60 data fields that describe the physical and regulatory aspects of a dam.

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 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 FY 2010, the Corps completed its most recent update to the NID. The update captures more accurate and more comprehensive data on existing dams, changes in existing dams, and new dams. 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. This approach 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.

There are two levels of access to the NID: Government and non-Government. All users can view summary charts and data. Government users can access restricted fields, such as downstream hazard potential. Government users also can download NID data by specific query or by State.

Dam Safety Program Management Tools

Since the authorization and implementation of the NDSP, 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; and
- Supporting dam safety professionals responsible for evaluating and maintaining the safety of dams in the United States.

The Dam Safety Program Management Tools (DSPMT) program is an information collection and management system that is controlled locally by Federal and State dam safety program managers. It interacts with national external cooperative information resources to provide as-requested and periodic information.

The DSPMT includes three distinct, complementary, and interoperable software programs:

- The Dam Safety Program Performance Measures (DSPPM);
- The NID Electronic Submittal Workflow; and
- Dam Safety Program Reporting Tools.

Dam Safety Program Performance Measures

The performance measures, or indicators, use unbiased data to assess effectiveness of dam safety programs and organizations. Performance measure output at each level in an organization can be used to evaluate the 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 progress on broader scales, such as district, division, agency, or State. Historical data sets allow the 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. It helps users provide a consistent, error-checked electronic submittal of inventory information.

Dam Safety Program Reporting Tools

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

An ongoing concern has been how to continue to maintain high levels of State participation when providing requested data in an environment of increasing requests for additional data. The DSPMT has been modified to support a combined reporting workflow so that all of the data requests can be satisfied with an annual one-time-only electronic data report. The electronic reporting interface is enhanced by the most recently published NID, so recommendations on the combined dam safety program questions can be made where possible. This should improve the accuracy and quality of the data being reported to the national oversight organizations.

III. National Dam Safety Program Activities

A. Overview

The Dam Safety Act of 2006 provides for assistance to the States to improve State dam safety programs and funds for training and for a program of technical and archival research. Fiscal Year (FY) 2008 through 2011 accomplishments in these areas, along with an emergency action planning initiative, is described in this Chapter.

B. The State Assistance Program

The importance of funding provided to States participating in the NDSP cannot be overstated. The States, which regulate approximately 80 percent of the 84,014 dams listed in the 2010 update to the NID, are responsible for ensuring the safety of these dams.

According to the *2009 Report Card* from the American Society of Civil Engineers (ASCE), “as dams age and downstream development increases, the number of deficient dams has risen to more than 4,000, including 1,819 high-hazard potential dams. Over the past 6 years, for every deficient, high-hazard potential dam repaired, nearly two more were declared deficient.” There also is an ongoing concern over the increase in the number of high-hazard potential dams nationwide whose failure would cause loss of life. Since 1998, the number of State-regulated high-hazard potential dams has increased from 9,075 to 11,389). This increase is primarily caused by increased development downstream of existing dams. Although the majority of these dams meet safety standards, their potential to cause loss of life demands stringent oversight, an often overwhelming challenge for State dam safety programs.

According to reports submitted to the ASDSO for 2010, there were 43 dam safety incidents, and 17 of those were failures. There were no fatalities associated with any of these failures, largely as a result of the dedication and hard work of the caretakers of State-regulated dams in the United States. The large majority of the incidents resulted from severe storms in Tennessee in May 2010 and in Texas and Nebraska in June 2010. The prerequisite for State participation in the NDSP is the establishment of a State regulatory program for dam safety. With the exception of Alabama, all of the States and Puerto Rico have regulatory programs and participate in the NDSP. A continuing goal of the Program is for Alabama to enact legislation so that it too can participate, and bring the number of participating States to 50.⁴

Although the programs vary in the scope of their authority, State 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 EAPs. The State assistance component of the NDSP is intended to

⁴ Other DHS/FEMA grant programs to State and local governments for hazard mitigation activities include the Emergency Management Performance Grants (EMPG) Program and Pre-Disaster Mitigation (PDM) Grants.

help States bring the necessary resources to bear on inspection, classification, and emergency planning for dam safety. The Program allows the States to identify their own priorities where dams are concerned and to take appropriate action according to available resources.

For a State to qualify for assistance in the NDSP, State appropriations must be budgeted to carry out State legislation. For a State to be eligible for assistance, the State dam safety program must be working toward meeting the following criteria, as listed in Public Law 109-460:

- 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.

State Assistance in FY 2008 through 2011

Table 1 lists the sum of State assistance amounts allocated by FEMA for FY 2008 through 2011 per State. For these fiscal years, FEMA awarded approximately \$24 million in assistance funds to Puerto Rico and the 49 States that participate in the NDSP.

State Assistance funds for FY 2008 through 2011 awards are based on the total number of all dams (low-, significant-, and high-hazard potential) the State reports to the NID.

To improve the effectiveness of the Dam Safety State Assistance Grant Program, in FY 2013, FEMA will implement performance-based eligibility criteria for awarding dam safety State

assistance grants. Instituting performance-based criteria will ensure that grants are only awarded to State dam safety programs that can efficiently and effectively utilize the funds to improve dam safety and meet the National Dam Safety Program goals and objectives.

State Performance

In the previous reporting period, the Review Board identified performance measures for States participating in the NDSP that focused on reducing loss of life and property damage from dam failures. The performance measures include the identification of deficient dams, the number of dam inspections, and the number of EAPs for high-hazard potential dams. These performance measures have been tracked by the DSPMT. All States, with the exception of Alabama, provided performance data to the DSPMT in 2008 through 2011 reporting years.

FEMA, after consultation with the Review Board, provided participating States with specific guidance on the use of their assistance funds toward meeting targets established for the performance measures. For example, those States with EAPs on less than 75 percent of their State-regulated high-hazard potential dams were required to expend 25 percent of their assistance funds on activities designed to increase the number of EAPs, in accordance with the intent of the Dam Safety Act. The EAP requirement has been carried over for each fiscal year's assistance, along with the requirements for inspections of State-regulated high-hazard potential dams.

Table 1: Sum of State Assistance in FY 2008 through FY 2011 per State

STATE	FY 2008-2011 Awards	STATE	FY 2008-2011 Awards
Alabama*	95,942	Nebraska	731,480
Alaska**	130,477	Nevada	284,680
Arizona	229,997	New Hampshire	323,526
Arkansas	449,470	New Jersey	364,044
California	476,228	New Mexico	257,633
Colorado	573,363	New York	640,535
Connecticut	340,457	North Carolina	879,438
Delaware	180,654	North Dakota	372,570
Florida	375,075	Ohio	533,752
Georgia	748,630	Oklahoma	1,080,732
Hawaii	123,657	Oregon	376,035
Idaho	254,259	Pennsylvania	506,304
Illinois	501,104	Puerto Rico	125,731***
Indiana	399,020	Rhode Island	209,467
Iowa	978,171	South Carolina	606,483
Kansas	1,620,360	South Dakota****	550,394
Kentucky	397,882	Tennessee	323,369

STATE	FY 2008-2011 Awards	STATE	FY 2008-2011 Awards
Louisiana	299,547	Texas	1,888,868
Maine	204,386	Utah	339,447
Maryland	247,946	Vermont	253,755
Massachusetts	435,434	Virginia	543,585
Michigan	815,772	Washington	416,312
Minnesota	376,757	West Virginia	275,805
Mississippi	1,025,373	Wisconsin	399,949
Missouri	330,908	Wyoming	506,924
Montana	811,731		

*Alabama received funds in FY 2010 and 2011 to assist with the establishment of a State dam safety program.

**Alaska did not request its FY 2009 funds.

***Puerto Rico did not request its FY 2011 funds.

**** South Dakota requested only a portion of its FY 2009 funds.

Dams in Need of Remediation

FY 1998 and 1999 was the first period for which the States provided FEMA with data on structural remediation⁵ needs, the number of dam inspections conducted each year, and the status of dams with EAPs by hazard potential classification. Figure 1 shows the number of State-regulated high-hazard potential dams in need of remediation for the period 1999-2011.

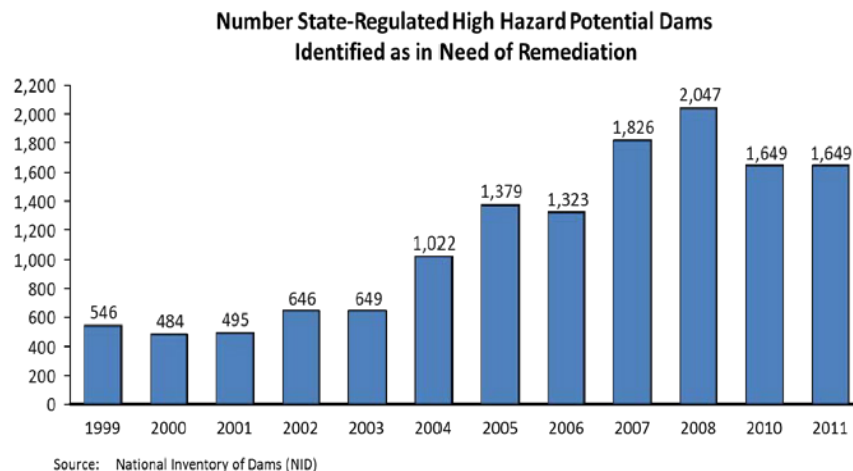


Figure 1: State-Regulated High-Hazard Potential Dams in Need of Remediation: 1999-2011

Source: National Inventory of Dams

As shown in Figure 2, the percentage of remediated State-regulated high-hazard potential dams has decreased significantly from approximately 30 percent of those identified to be in need of remediation in 1999 to 10 percent of those identified to be in need of remediation in 2011. The increase in the number of dams in need of remediation results from a combination of factors,

⁵ “Structural remediation” is defined as a structural solution to remove the dam safety problem. This can include the addition of a larger spillway, repair of the structure, or removal of the dam.

including more dams in the inventory, more inspections being performed, better inspections, better reporting of inspection results, aging infrastructure, and an increased backlog of dams requiring remediation. Conversely, the number of dams being remediated each year is significantly less than the number of dams in need of remediation.

Given the limited resources available to State dam safety programs and the absence of a funding program for the remediation of dams, this data is of particular concern. In 2009, ASDSO estimated that the total cost to repair the Nation’s dams at \$50 billion and the needed investment to repair high-hazard potential dams at \$16 billion. The 2009 report noted that an additional investment of \$12 billion over 10 years would be needed to eliminate the existing backlog of more than 4,000 deficient dams.

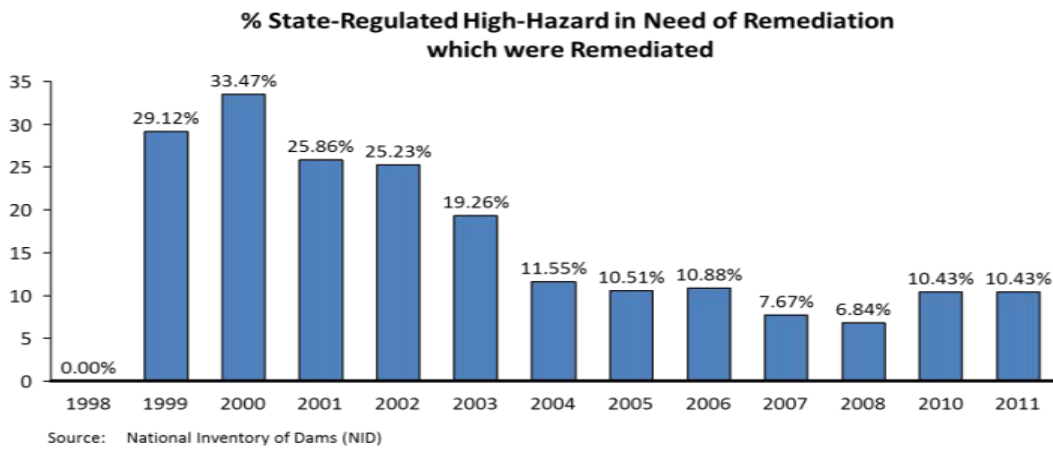


Figure 2: Percentage of State-Regulated High-Hazard Potential Dams in Need of Remediation Which Were Remediated: 1999-2011

Source: National Inventory of Dams

Dam Inspections

As the number of high-hazard potential dams has increased, so has the number of inspections being performed. Data provided by the States on their mandated inspection frequencies and the percentage of inspections performed (Figure 3) indicate that the States are currently performing the required number of inspections. Improvement in this area will be possible only by increasing the mandated inspection intervals, as shown in Figure 4.

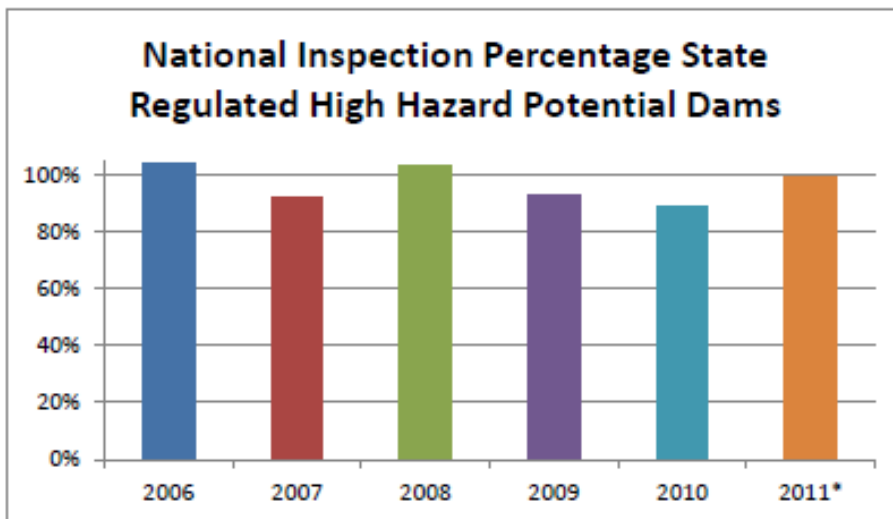


Figure 3: Inspection % of State-Regulated High-Hazard Potential Dams

Source: National Inventory of Dam

* In 2011, 48% of the States performed formal inspections for high-hazard potential dams, but 57% of the total high-hazard potential dam inspections were formal.

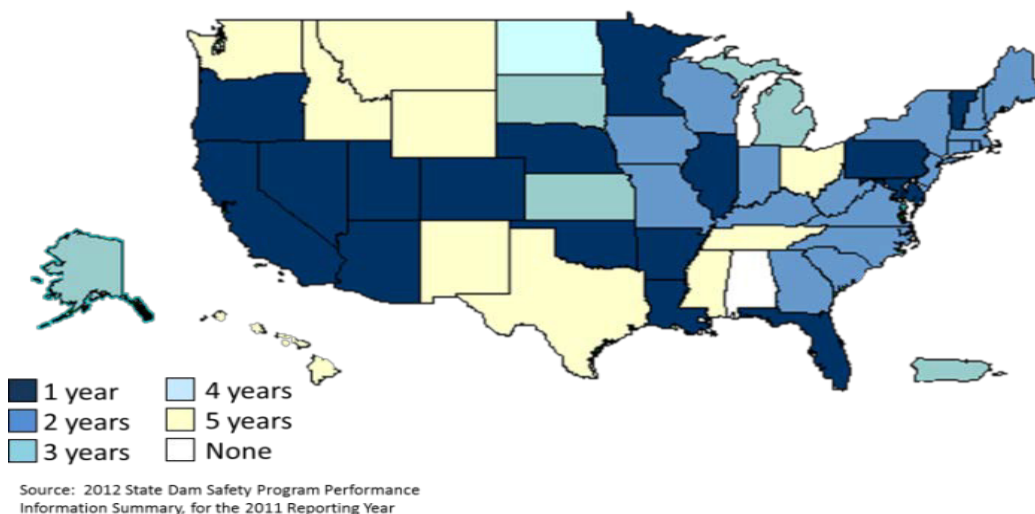


Figure 4: Inspection Intervals for State-Regulated High-Hazard Potential Dams

Source: National Inventory of Dams

Emergency Action Planning

An EAP is one of the primary safeguards against the loss of life and property damage that can result from the failure of a high-hazard potential dam. Since the establishment of the NDSP, the States have made progress in increasing the number of State-regulated high-hazard potential dams with EAPs. More must be done, however, to reach the goal recommended in January 2006

by the Review Board for States to increase their EAP compliance for high-hazard potential dams 10 percent each year.

In October 2005, the losses from Hurricane Katrina had just exposed significant failures in the Nation's emergency planning and response system. The failure of the emergency management system to respond quickly and effectively to the disaster brought to the forefront the need for all hazard areas, including dam safety, to refocus their attention on this critical requirement.

To address these issues, FEMA established the Task Group on Emergency Action Planning and Response in January 2006 to assist the Review Board in making recommendations. In September 2006, the Task Group completed *Emergency Action Planning for State-Regulated High-Hazard Potential Dams: Findings, Recommendations, and Strategies*. This document, which was approved by the Review Board in October 2006, served as the basis for the Task Group Action Plan for future initiatives in emergency action planning. The top priority identified in the Action Plan was the development of an outreach and marketing campaign to promote the implementation of EAPs for State-regulated high-hazard potential dams. Additional Information on this project is provided below.

In January 2008, the Review Board voted unanimously to recommend that FEMA require that States with less than 75 percent EAP compliance on State-regulated high-hazard potential dams devote at least 25 percent of their assistance funds, beginning in FY 2008, to increase the number of EAPs for these dams by at least 10 percent each year. Some of the activities undertaken by the States to reach this goal are listed below:

- Hiring a part-time EAP coordinator to assist with the development of EAPs;
- Hosting regional EAP awareness workshops for the public, local emergency managers, and owners of critical facilities;
- Hosting functional and tabletop exercises;
- Implementing an outreach plan and marketing strategy for dam owners and local emergency management officials without EAPs;
- Providing dam owners and emergency managers with inundation maps that may result in the development of an EAP;
- Hosting statewide and local workshops on the development of EAPs for dam owners and local emergency managers; and
- Sending correspondence to dam owners on the need for EAPs and on the value of the process itself.

Each reporting period, the States have reported increases in the number of State-regulated high-hazard potential dams with an EAP (see Figure 5).

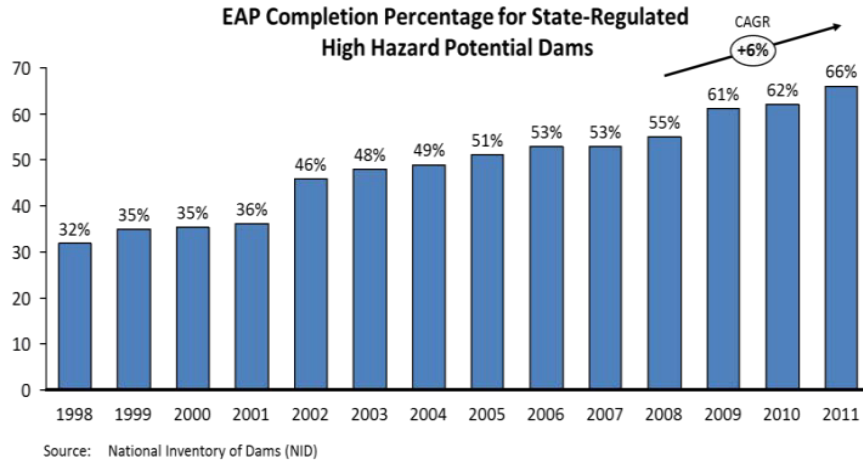


Figure 5: EAP Completion Percentage for State-Regulated High-Hazard Potential Dams
Source: National Inventory of Dams

Today, approximately 66 percent of all State-regulated high-hazard potential dams have an EAP (Figure 6 and Table 2). Data from the DSPMT indicate that State-regulated high-hazard potential dams that do not require EAPs (2,097) are not a significant contributor to the number of dams without EAPs. The largest contributor to dams without EAPs is simply State-regulated dams for which an EAP has not been prepared.

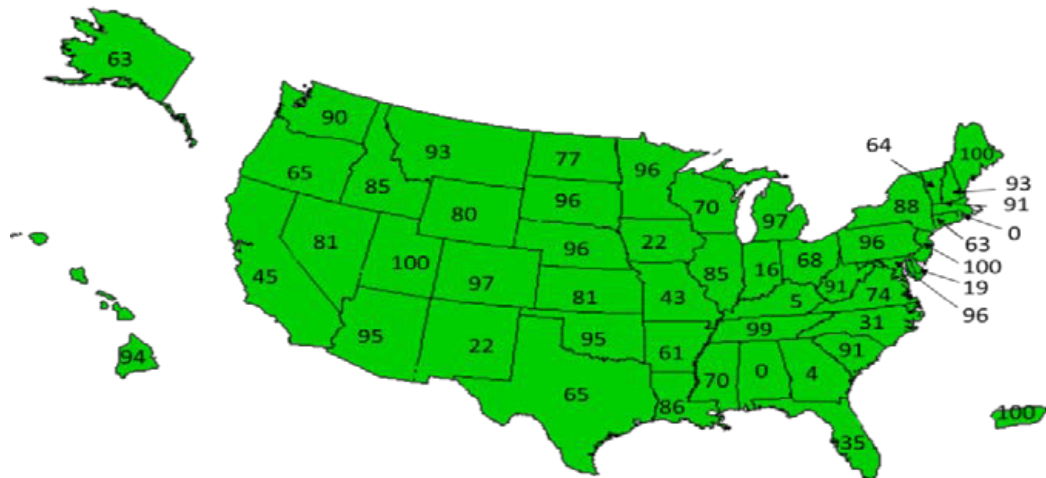


Figure 6: Percentage of State-Regulated High-Hazard Potential Dams with an EAP
Source: National Inventory of Dams

Table 2: State-Regulated High-Hazard Potential (HHP) Dams with an EAP

STATE	Authority to Require EAP?	State-Regulated HHP Dams	State-Regulated HHP Dams w/EAP	State-Regulated HHP Dams w/EAP
ALABAMA	No	0	0	0%
ALASKA	Yes	19	12	63%
ARIZONA	Yes	101	96	95%
ARKANSAS	Yes	152	92	61%
CALIFORNIA	No	690	309	45%
COLORADO	Yes	367	357	97%
CONNECTICUT	Yes	240	151	63%
DELAWARE	Yes	43	8	19%
FLORIDA	Yes	72	25	35%
GEORGIA	No	474	17	4%
HAWAII	Yes	125	117	94%
IDAHO	No	114	97	85%
ILLINOIS	Yes	217	185	85%
INDIANA	No	243	38	16%
IOWA	No	91	20	22%
KANSAS	Yes	220	178	81%
KENTUCKY	No	169	8	5%
LOUISIANA	Yes	36	31	86%
MAINE	Yes	30	30	100%
MARYLAND	Yes	74	71	96%
MASSACHUSETTS	Yes	303	276	91%
MICHIGAN	Yes	88	85	97%
MINNESOTA	Yes	24	23	96%
MISSISSIPPI	Yes	256	180	70%
MISSOURI	Yes	462	197	43%
MONTANA	Yes	103	96	93%
NEBRASKA	Yes	132	127	96%
NEVADA	Yes	148	120	81%
NEW HAMPSHIRE	Yes	137	127	93%
NEW JERSEY	Yes	214	214	100%
NEW MEXICO	Yes	151	33	22%
NEW YORK	Yes	396	347	88%
NORTH CAROLINA	No	1,126	351	31%
NORTH DAKOTA	Yes	30	23	77%

STATE	Authority to Require EAP?	State-Regulated HHP Dams	State-Regulated HHP Dams w/EAP	State-Regulated HHP Dams w/EAP
OHIO	Yes	366	248	68%
OKLAHOMA	Yes	321	304	95%
OREGON	Yes	130	84	65%
PENNSYLVANIA	Yes	776	743	96%
PUERTO RICO	Yes	35	35	100%
RHODE ISLAND	Yes	97	0	0%
SOUTH CAROLINA	Yes	160	145	91%
SOUTH DAKOTA	Yes	46	44	96%
TENNESSEE	Yes	149	147	99%
TEXAS	Yes	1,048	678	65%
UTAH	Yes	197	196	99%
VERMONT	No	39	25	64%
VIRGINIA	Yes	273	201	74%
WASHINGTON	Yes	179	161	90%
WEST VIRGINIA	Yes	257	233	91%
WISCONSIN	Yes	188	132	70%
WYOMING	No	81	65	80%

Public Outreach

In FY 2008, FEMA began work on an EAP marketing and outreach campaign for the States. This successful pilot project, which was concluded in spring 2011, promoted the implementation of EAPs for high-hazard potential dams and targeted dam owners, State emergency managers, regulators, selected State government officials, the news media, and the public. The three States participating in the project were Missouri (dam owners), Texas (regulators), and North Carolina (emergency managers). Project work focused on communication strategies, including email, direct mail, post cards, news releases, Public Service Announcements, workshops, enlisting the support of mayors and businesses, interviews with radio stations, and the creation of a Web site (<http://www.damsafetyaction.org/>). As part of the initiative, three brochures focusing on dam owners, the public, and inundation mapping were developed. The Review Board Work Group on Emergency Action Planning is reviewing the final project report and developing recommendations for adapting and expanding the project for national implementation.

Beginning in FY 2009, States are allocating a portion of their assistance funds to outreach and public awareness on the flood risks presented by dams to the downstream public and critical facilities. Activities can include developing a comprehensive outreach and public awareness plan; creating messages on the risk posed by dams and tailoring the content, delivery, and packaging the messages for appropriate audiences; and developing innovative programs and

venues to reach diverse audiences. A number of States, such as Kansas, have already established successful outreach programs to promote dam safety.

State Success Stories

During this reporting period, States participating in the NDSP used their assistance funds for many projects and activities designed to further mitigation at the local level. Below are selected success stories from four States.

Virginia Report to the Governor on Costs of Dam Repairs

Virginia developed a process for estimating costs and prioritization for dam safety rehabilitation needs and used this process to develop a report, “Costs, Funding and Prioritization of Virginia Dams to Meet Minimum Public Safety Standards,” for the Governor. The State identified dams in need of repair and estimated the costs to meet the public safety standards. The report was responsible for the Governor’s recommendation and the Legislature’s approval of \$14 million for the repair of State-owned high-hazard potential dams.

Texas Reports Significant Improvement in EAPs

Texas has used its grant funds to increase the number of EAPs for high-hazard potential dams. In 2008, only 17 percent of high-hazard potential dams had an EAP. In 2009, Texas passed rules requiring EAPs for all high- and significant-hazard potential dams and used NDSP grant funds to retain a consultant to perform simplified breach studies for use in EAPs. The State also used grant funds to hold workshops to discuss EAPs with dam owners. In 2011, 65 percent of the high-hazard potential dams had an EAP.

Ohio Dam Owners Receive Discount for Maintaining Dams

As an incentive to encourage dam owners to safely maintain their dams, Ohio implemented a program that provides a discounted annual inspection fee of up to 25 percent for the dams that meet the standards of the Ohio Dam Safety Department. The amounts paid vary according to the size and class of the dam.

New York Allows Public to See Dam Data with Google Earth

New York uses a form of Google Earth to pinpoint dams by hazard classification. The New York Dam Safety Web site (<http://www.dec.ny.gov/lands/4991.html>) shows New York’s inventory of dams mapped in a Google Earth-readable file, categorized by hazard classification.

C. Training

Since the inception of the NDSP, FEMA has supported a strong, collaborative training program for dam safety professionals and dam owners. With the training funds provided under the Dam Safety Act of 2006 (Public Law 109-460), FEMA has continued to expand existing training programs, begun new initiatives to keep abreast with evolving technology, and enhance the sharing of expertise between the Federal and State sectors.

As part of its leadership responsibilities, FEMA convened a Dam Safety Training Summit in 2010 to gather stakeholder input for a National Dam Safety Training Plan. The recommendations from the Summit are now being implemented by FEMA and its partners and will be incorporated into the new Strategic Plan for the NDSP for FY 2012 through 2016. Outcomes to date include the development of dam consequence assessment training and start-up work on a standard course of study for dam safety professionals.

During this reporting period, FEMA funding supported the training of more than 6,000 stakeholders at dam safety workshops, seminars, and courses across the United States. FEMA and its partners will continue to develop and promote training that furthers one of the goals for the NDSP: to develop a workforce of engineers, scientists, technologists, and well-prepared citizens.

The training activities conducted under the NDSP fall under one of three components: national training initiatives, most of which are conducted at FEMA's Emergency Management Institute (EMI); regional technical training conducted by ASDSO; and local training through direct assistance to the States and self-paced training.

National Training Initiatives

An important national training initiative is the National Dam Safety Program Technical Workshop Series. The goal is 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 engineers in the dam safety community.

The Technical Workshop Series are national in scope and inclusive of State and local dam safety professionals and the private sector. The Technical Workshops have hosted a distinguished roster of speakers. More than 4,000 participants from the State, Federal, and private sectors have attended the Technical Workshops.

To date, 19 Technical Workshops have been held, including the four Workshops held during this reporting period at EMI:

- Technical Seminar No. 15, *Lessons Learned from Dam Failures and Incidents*, February 2008
- Technical Seminar No. 16, *Handling Emergencies at Dams*, February 2009
- Technical Seminar No. 17, *Risk Management in Dam Safety*, February 2010
- Technical Seminar No. 18, *Instrumentation and Remote Operation of Dams*, February 2011

Another ongoing and successful training initiative is the Corps Hydrologic Engineering Center (HEC) River Analysis System (RAS) software. 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 Hydrologic Modeling System (HMS) program simulates 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 NDSP supports a HEC-RAS course and a HEC- HMS course for approximately 30 students at EMI.

Regional Technical Training

FEMA has provided ASDSO with funds to develop and conduct regional and technical training courses, ASDSO advanced technical seminars, and an annual conference that provides extensive training for attendees. On average, ASDSO has conducted five regional training courses and two advanced technical seminars each year with NDSP funding. The topics have included soil mechanics, plant and animal penetrations of earthen dams, hydraulic analysis of spillways, seepage, and emergency action planning, among others. Training funds provided under the NDSP also supported the launch of ASDSO's Web-based dam safety training workshops. The first pilot course was broadcast from a virtual classroom at the Missouri Institute of Science and Technology in December 2007 on Geotechnical Review of Embankment Projects. The second pilot workshop, Fundamentals of Hydrology, was presented in June 2008 at Penn State. Since then, ASDSO has offered about 10 webinars each year.

Local and Self-Paced Training

Training funds for State dam safety officials have been a mainstay of the NDSP. 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.

The Training Aids for Dam Safety (TADS) program is one of the most successful training initiatives of FEMA and its partners. TADS is a self-contained, self-paced training course consisting of 21 modules (workbooks and videos) for engineers, technicians, dam owners, water resource managers, public officials, and the public. In FY 2008, FEMA completed the digitization of all 21 TADS workbooks and videos into DVD format. *Training Aids for Dam Safety (TADS): A Self-Instructional Study Course in Dam Safety Practices*, FEMA 609DVD, was published and distributed in fall 2008.

D. Research

Research is critical to the Nation's agenda for dam safety. Research funding under the NDSP addressed a cross-section of issues and needs in FY 2008 through FY 2011, all in support of ultimately making dams in the United States safer.

As the leader of the NDSP, FEMA's concern is to prevent loss of life from dam failure. In recent years, this concern has been heightened by the state of dam disrepair in the United States. To address this most important need, FEMA is providing State dam safety officials, dam owners, Federal dam safety officials, and others with a tool to identify and prioritize dams according to the risks they pose. Ultimately, FEMA expects this information to be shared with the downstream public, emergency managers, and others to prevent loss of life, safeguard the environment, and mitigate property losses from dam failure.

In FY 2010, FEMA convened a Research Summit and Research Workshop to develop a new 5-year Research Strategic Plan and to identify emerging priorities in the areas of resilience, emergency management, and dam infrastructure. This broader view is based on lessons learned from Hurricane Katrina and the addition of “ensuring resilience to disasters” as one of the five priority mission areas from the DHS 2010 Quadrennial Homeland Security Review Report. Another important goal is to expand the research program from its focus on Federal engineering research and to implement a better cross-walk between research products and training offered to stakeholders.

Working with its partners, FEMA is also developing a new business model to accomplish all components of the research role, in particular those related to emerging and transformational research. The business model will be based on a consortium of partners and organizations that can share project costs and help to find new sources of revenue.

New Resources and Tools

The *Risk Prioritization Tool for Dams*, FEMA P-713CD, was developed through Research Program funds over a 3-year period. The software provides a simple, flexible, easy to implement decisionmaking procedure for users to identify and prioritize dams within a large inventory. The tool enhances the users’ understanding of key contributors to risk at each dam; is a systematic, unbiased, and logical framework for prioritizing and committing often limited resources; is applicable to any type or number of dams; and provides an effective way to communicate dam safety risk to decisionmakers. FEMA P-713CD, *Risk Prioritization Tool for Dams*, was made available by FEMA on CD and online in FY 2008.

Other products produced during this reporting period with research funds include:

- FEMA 602, *Final Report on Coordination and Cooperation with the European Union on Embankment Failure Analysis*, developed with the U.S. Department of Agriculture, Agricultural Research Service.
- FEMA P-675, *Technical Manual: Plastic Pipe Used in Embankment Dams*, developed by a joint Federal and State committee led by the Department of the Interior, Bureau of Reclamation
- FEMA P-679DVD, *Technical Manual: Outlet Works Energy Dissipaters, Best Practices for Design, Construction, Problem Identification and Evaluation, Inspection, Maintenance, Renovation, and Repair*, developed with the Bureau of Reclamation.
- FEMA P-730CD, *Technical Report: Use of Geotextiles in Embankment Dams*, developed with the Bureau of Reclamation.
- FEMA P-911, *The Pocket Safety Guide for Dams*, developed with the USFS
- Improvement of Regression Equations for Analysis of Embankment Dam Breaching, developed with Colorado State University.
- *Guidance for Design and Installation of Granular Filters within Embankment Dams*, developed with the U.S. Army Corps of Engineers.
- *Best Operation & Maintenance (O&M) Practices for Gates*, Corps

Projects scheduled for completion by the end of the next reporting period include:

- Guidance for the Design and Construction of Overtopping Protection Systems for Earthen Embankments
- Dam Hazard Consequences Assessment Guidelines and Toolkit
- Guidelines for Standard Approaches to the Inundation Mapping of Flood Risk Associated with Dam Incidents and Failures
- Integration of Dam Operations, Emergency Management, and Warning Systems
- Guidelines for Risk-Based Hydrologic Safety
- Liquefaction Prediction and Seismic Performance of Small Dams Guidelines

E. Emergency Action Planning Initiatives

FEMA and the dam safety community recognize that the implementation of EAPs for all high- and significant-hazard potential dams in the United States is critical to reducing the risk of loss of life and property damage from dam failures. At its January 2008 meeting, the Review Board voted to recommend that FEMA require States participating in the NDSP to increase by at least 10 percent each year the number of their State-regulated high-hazard potential dams with EAPs. To assist with this and other EAP initiatives, FEMA established a new standing Work Group on Emergency Action Planning for Dams in January 2009.

The primary focus of the Work Group since its establishment has been the Send a Letter project and the updating of the FEMA 64 *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*. The Send a Letter project requests that States contact the owners of high-hazard potential dams without EAPs and ask the owners to develop an EAP. The Work Group prepared two letters for the project, one for States with EAP regulatory authority and one for States without EAP regulatory authority. The effort from this initiative contributed to the increase of high-hazard potential dams with EAPs from 61 percent in 2009 to 66 percent in 2011. This equates to approximately 700 new EAPs.

In 2010, a Task Group was established under the Work Group on Emergency Action Planning for Dams to review FEMA 64, *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners*, and make recommendations for updating the guideline. The updated guideline, which will be finalized in early FY 2013, encourages comprehensive and consistent emergency action planning to protect lives and reduce property damage, and emphasizes the participation of emergency management authorities and dam owners. The updated guideline also incorporates approaches and practices consistent with the National Response Framework and many contemporary emergency action planning concepts available from a variety of sources.

Other activities and initiatives of the Work Group over the next 2 years will include the following:

- Develop a national program that implements the results of the EAP pilot study project concluded in FY 2010;
- Review the findings and recommendations contained in the *Emergency Action Planning for High-Hazard Potential Dams: Findings, Recommendations, and Strategies*, FEMA 608, and develop a strategy to implement appropriate recommendations, with a particular focus on public outreach and awareness; and
- Coordinate with the Work Group on Dam Safety Training for cross-training opportunities with Federal and State agencies, the private sector, and organizations focused on training.

IV. Federal Agency Programs

A. Overview

Although the Federal Government owns or regulates only about 6.5 percent of the dams in the United States, many of the dams are significant in terms of size,⁶ function, benefit to the public, and their hazard potential (see Figure 7).

The October 4, 1979, Presidential memorandum that directed Federal agencies responsible for dams to adopt and implement the *Federal Guidelines for Dam Safety (Guidelines)* also directed the heads of these agencies to submit progress reports to the Administrator of the Federal Emergency Management Agency (FEMA). Since that initial report in 1980, the Administrator of FEMA has solicited follow-up progress reports from the agencies at 2-year intervals. Below is a description of Federal agency responsibilities for dam safety.

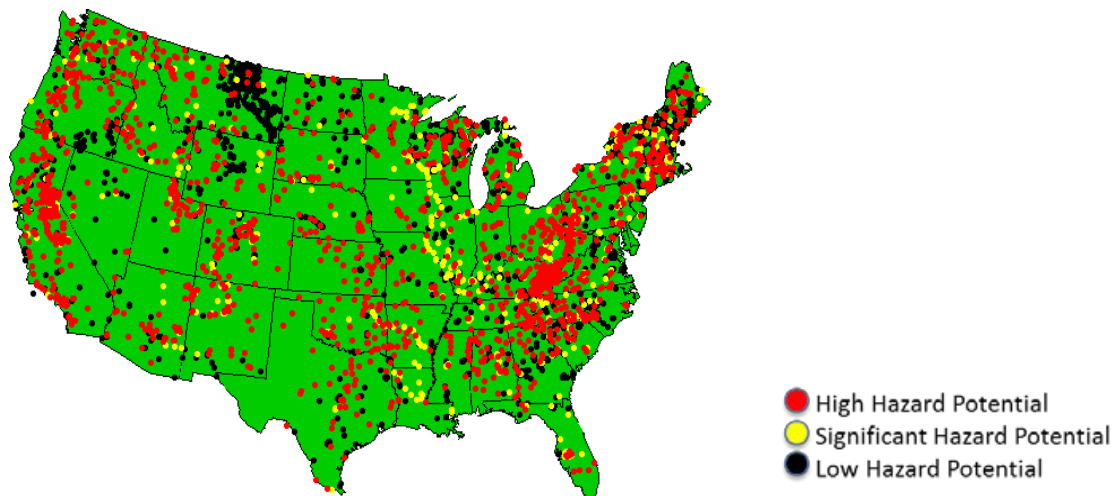


Figure 7 Dams Reported to the NID by Federal Agencies

Source: National Inventory of Dams

B. Federal Agency Responsibilities

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 included in the NID. USDA dams provide livestock water, municipal water and wastewater treatment, industrial

⁶ The Dam Safety Act of 2006 defines dam size as any artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water, that is: 1) 25 feet or more in height from the natural bed of the stream channel or watercourse measured at the downstream toe of the barrier or 2) has an impounding capacity for maximum storage elevation of 50 acre-feet or more.

water, flood protection, irrigation, fish and wildlife habitat, recreation, sediment detention, and manure storage and treatment. Six USDA agencies are involved with dams.

Agricultural Research Service (ARS) conducts internationally recognized research in hydrologic, hydraulic, erosion, and sedimentation processes applicable to dams. ARS partners with the NRCS in the development of the technology required for the design, construction, maintenance, rehabilitation, and safety of the dams constructed with USDA assistance and works closely with NRCS to identify technology needs and implement research results. ARS is responsible for one NID-size dam at one of its research facilities.

Farm Services Agency (FSA) provides financial assistance for dams through loans, loan guarantees, and grants to farmers and ranchers for land and water resource conservation or natural disaster recovery. FSA financial assistance is limited and typically provides only a small portion of the cost of small dams.

U.S. Forest Service (USFS) designs, finances, constructs, owns, operates, maintains, and regulates dams in conjunction with the management of national forests and grasslands. USFS owns approximately 1,000 NID-size dams and administers permits for approximately 2,000 privately owned NID-size dams. For the permitted dams, the dam owner designs, constructs, and operates the dam and USFS reviews and approves activities related to safety of the dam. Although FS has a direct responsibility for dams as an owner, it does not specifically budget or fund accounts for dam safety improvements.

Natural Resources Conservation Service (NRCS) designs, finances, and constructs dams under its technical and financial assistance programs for individuals, groups, organizations, and governmental units for water storage, sediment detention, and flood protection. NRCS has provided technical assistance for almost 27,000 NID-sized dams and financial assistance for more than 11,000 of these dams.

Rural Housing Service (RHS) finances dams through loans, loan guarantees, and grants to public entities, local organizations, and non-profit corporations for rural community facilities. Less than 60 NID-size dams have been financed under former or current programs.

Rural Utilities Service (RUS) 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. RUS 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 90 NID-sized dams are financed under these former or current programs.

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

- **Department of the Air Force (Air Force)** is responsible for dams located on Air Force bases in the continental United States. The Air Force has jurisdiction over 23 dams.

- **Department of the Army (Army)** Installation Management Command (IMCOM) is responsible for dams either on Army garrisons or controlled by Army garrisons. The Army has jurisdiction over 248 dams.
- **Department of the Navy (Navy)** has dam safety responsibility for dams located on Navy bases. There are 29 dams under Navy jurisdiction for safety inspections.
- **U.S. Army Corps of Engineers (Corps)** has a diverse inventory of 693 dams in 44 States. The dams serve a variety of purposes, including navigation, flood risk management, water supply, irrigation, hydropower, recreation, environmental, and combinations of these purposes. Corps dams vary in age from over 100 years to less than 10 years. Most have not been filled to their maximum design event.

Department of Energy (DOE) owns and has jurisdiction of 14 dams at 3 sites. The purpose of all DOE dams is water impoundment.

Department of the Interior (DOI) has a mission to protect and provide access to the Nation's natural and cultural heritage and honor trust responsibilities to Indian Tribes and commitments to island communities. As the Nation's principal conservation agency, DOI is responsible for most of the U.S.-owned public lands and natural resources. Through its Bureaus, DOI is responsible for the planning, design, construction, operation, and maintenance of nearly 2,700 dams meeting the reporting requirements of the NID.

Bureau of Indian Affairs (BIA) is responsible for all dams on Indian lands, in accordance with the Indian Dam Safety Act of 1994 (Public Law 103-302). BIA is responsible for 910 dams on Indian reservations. The BIA Safety of Dams program works with Indian Tribes to maintain these dams.

Bureau of Land Management (BLM) is responsible for DOI BLM-owned dams on public lands in 11 Western States, including Alaska. DOI BLM owns 685 dams. In addition, approximately 310 private/permitted dams reside on DOI BLM-administered lands.

Bureau of Reclamation (Reclamation) is a Federal water resource management and development bureau authorized to operate in 17 Western States. The DOI Reclamation inventory currently consists of 476 dams and dikes⁷ throughout the West.

U.S. Fish and Wildlife (FWS) operates facilities associated with fish and wildlife conservation. DOI FWS dams and water control structures are located on National Wildlife Refuges, waterfowl production areas, and national fish hatcheries. DOI FWS has 255 dams.

National Park Service (NPS) is charged with minimizing the risk posed by dams and water impoundment structures to DOI NPS natural and cultural resources, facilities, personnel, and visitors. While direct responsibility for the safety of all NPS facilities rests with the individual

⁷ Reclamation defines a "dike" as (1) a low embankment, usually constructed to close up low areas of the reservoir rim and thus limit the extent of the reservoir; (2) an embankment for restraining a river or a stream; or (3) an embankment which contains water within a given course. The term is usually applied to dams built to protect land from flooding.

NPS superintendents, the NPS Dam Safety Program is responsible for enabling and facilitating implementation of departmental manual guidance on dam safety.

Office of Surface Mining (OSM) ensures that dams under its regulatory authority do not present unacceptable risks to public safety, property, and the environment. OSM does not own any dams. OSM oversees 69 dams.

U.S. Geological Survey (USGS) owns and maintains one embankment dam.

Department of Labor, Mine Safety and Health Administration (MSHA) is responsible for protecting the health and safety of miners working at mines in the United States under the Federal Mine Safety and Health Act of 1977 (Mine Act). Section 3(h)(1) of the Mine Act defines a “coal or other mine.” Included within this definition are structures, facilities, or other property including impoundments, retention dams, and tailings ponds used in or to be used in, or resulting from the work of extracting minerals or used in, or to be used in, the milling of minerals. MSHA regulates U.S. mines, mine operators, and miners under Title 30 of the Code of Federal Regulations (CFR).

Specifically, mandatory safety standard 30 CFR 77.216 (“Water, sediment, or slurry impoundments and impounding structures; general”) pertains to dams at surface coal mines and surface areas of underground coal mines and 30 CFR 56.20010 and 57.20010 (“Retaining dams”) pertain to dams at surface and underground metal and nonmetal mines. As of October 2011, there were 1,991 dams listed in the MSHA dam inventory.

Department of State, International Boundary and Water Commission (IBWC) is composed of a U.S. Section (USIBWC) and a Mexican Section; it is charged with carrying out the provisions of a number of treaties between the United States and Mexico. Among its responsibilities, IBWC has jurisdiction over two large international storage dams and four diversion dams on the Rio Grande and Colorado Rivers. The USIBWC is also responsible for the annual maintenance of the American Diversion Dam and five sediment control and flood control dams owned by the Caballo Soil and Water Conservation District. These dams are not fully international.

Federal Energy Regulatory Commission (FERC) is authorized by the Federal Power Act to issue licenses to individuals, corporations, states, and municipalities to construct, operate, and maintain dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary for the development of non-Federal hydroelectric projects (1) on navigable streams; (2) on public lands of the United States; (3) at any Government dam; and (4) on streams over which the Congress has jurisdiction under the Commerce Clause of the U.S. Constitution. As of September 1, 2011, there were 2,524 dams under FERC jurisdiction.

Nuclear Regulatory Commission (NRC) has regulatory authority over one uranium mill tailings dam, storage water pond dams at in situ leach mining facilities, and dams integral to the operation of licensed facilities or the possession and use of licensed material that pose a radiological safety-related hazard should they fail. Exceptions in the third category are dams that are submerged in other impoundments or dams regulated by other Federal agencies, e.g., the

Corps, FERC, or the Tennessee Valley Authority (TVA). The NRC regulates nine low-hazard-potential dams.

Tennessee Valley Authority (TVA) is authorized by the TVA Act of 1933 to approve plans for the construction, operation, and maintenance of all structures affecting flood control, navigation, or public lands or reservations in the Tennessee River System. TVA is responsible for the planning, design, construction, operation, and maintenance of 49 regulating dams and 41 coal combustion facilities.

C. Federal Agency Activities

In June 1979, the ad hoc ICODS issued the first guidelines for Federal agency dam owners. The *Guidelines* have withstood the test of time. Since their publication, all of the Federal agencies responsible for dams (the ICODS agencies) have implemented their provisions, sharing resources whenever possible to achieve results in dam safety, and developing strategies to address diminishing resources and decreases in staffing levels. Some of the Federal agencies also maintain comprehensive research and development and training programs.

For assessment purposes, FEMA supplies the ICODS agencies each reporting cycle with a format to ensure completeness and uniformity among responses. Using the format, the ICODS agencies supply a brief description of their dam safety responsibilities, following by a report on their progress in complying with the following areas covered by the *Guidelines*:

- Organization, Administration, and Staffing
- Independent Reviews
- Dam Inventories
- Inspection Programs
- Dam Safety Rehabilitation Programs
- Management Effectiveness Reviews
- Dam Safety Training
- Dam Failures and Remedial Actions
- Emergency Action Planning
- Research and Development and Special Initiatives
- State Dam Safety Agency Involvement
- Public Concerns

Below is a brief overview of Federal agency progress in FY 2008 through 2011 in these areas. Appendix B, Summary Status of Dams for Federal Agencies, provides data on the number of dams owned, operated, or regulated by each agency.

Organization, Administration, and Staffing

Reorganizations and reduction in overall staff and budget are continuing challenges faced by some of the ICODS agencies. Nonetheless, the reports from these agencies indicate that they are meeting their responsibilities for dam safety, often by implementing initiatives to function smarter and more efficiently. Some agencies, such as MSHA and FERC, report increases in staff during this reporting period.

Independent Reviews

This area of the *Guidelines* is being implemented by the ICODS agencies. The agencies with dams as a secondary function use engineer offices of other ICODS agencies with dams as a primary function or State dam safety engineers to provide independent reviews. Agencies with dams as a primary function use both internal and external private consultants for their independent reviews.

Dam Inventories

Maintenance of an accurate, up-to-date inventory is a direct measure of an agency's commitment to implementing the *Guidelines*, and is required to establish and monitor a dam safety program. All of the ICODS agencies are doing an excellent job in this area.

Inspection Programs

The inspection requirements of the *Guidelines* are being implemented into policy and practice by the ICODS agencies. All agencies with dams as a primary function have adequate inspection capability, schedules, and accomplishments. Agencies with dams as a secondary function face greater challenges, depending in part on whether the agency is a dam owner, financier but non-owner, or a regulator. For example, the USFS has a dual role. For USFS-owned dams, the agency accomplished 100 percent of its scheduled inspections. However, the USFS reports that safety evaluation compliance on its regulated dams is sporadic. Overall, the NID indicates that approximately 94 percent of Federal high-hazard potential dams have been inspected within the past 5 years.

Dam Safety Rehabilitation Programs

The ICODS agencies are implementing the *Guidelines* in this area and are dedicated to pursuing the repair and rehabilitation of dams found to have deficiencies. The costs associated with rehabilitation are high, and many agencies have developed processes for ranking comparative risks to prioritize projects.

Management Effectiveness Reviews

The TVA reported an external management effectiveness review of one of its programs during this reporting period, and several other agencies, including the FERC, reported internal reviews.

Dam Safety Training

The in-house dam safety training activities of the ICODS agencies are appropriate to their responsibilities, and most agencies are taking advantage of training opportunities from outside sources.

Dam Failures and Remedial Actions

The ICODS agencies have provided a comprehensive report on dam failures, near failures, and major incidents during this reporting period. Detailed descriptions of events, observations, and consequences associated with the incidents are included in the agency reports.

Emergency Action Planning

Most ICODS agencies continue to report progress in establishing EAPs and in testing exercises. FERC continues to do an exemplary job in emergency action planning and is a leader in this area. MSHA does not have statutory authority to require EAPs for downstream areas beyond mine property.

Research and Development and Special Initiatives

Research, and to a lesser degree special initiatives, are most appropriate to those agencies with dams as a major function. Highlights of ICODS agency work during this reporting period include the areas of risk assessment, modeling, development of guidance, instrumentation, digitization of mine maps, and data architecture.

State Dam Safety Agency Involvement

The ICODS agencies report purposeful, good relationships with the States, including State dam safety offices.

Public Concerns

Most ICODS agencies report formalized and effective procedures for taking issues to the public and for receiving comments from the public.

V. Focus on the Future

The Dam Safety Act of 2006 (Public Law 109-460) states that the FEMA Administrator will submit a report that describes the status of the National Dam Safety Program, including progress achieved by participating States and Federal agencies, and recommendations for legislative and other action that the Administrator considers necessary.

While the data for FY 2008 through 2011 are encouraging in many areas, the larger picture of dam safety continues to pose challenges. FEMA, as the lead agency for the Program, strongly believes that the driving force behind the Program is that many Americans are living below structurally deficient, high-hazard potential dams; they are unaware of the risk; there is no plan in place to evacuate them to safety in the event of a failure; or there is a plan in place but they are not aware of it. There is an immediate need to address these challenges.

In FY 2012 and beyond, the following vision and mission will serve as the cornerstone for all Program activities.

The vision is: A future in which the public safety, economic strength, environment, and national security of the United States are not threatened by the risk from dam failure.

The mission 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 that brings together the expertise and resources of the Federal and non-Federal communities in achieving national dam safety hazard reduction.

FEMA has identified the following strategies for the Program to help realize the vision and mission for the Program and to continue to keep the American public safe from dam failure.

Promote Community and Regional Resilience

Following a dam failure, communities must be able to quickly recover. Disaster-resilient communities must have credible response plans that recognize their inherent abilities to recover, and include places and plans for governing after a major disaster. While the Nation can promote resilience through improved dam design, dam rehabilitation, and mitigation strategies, implementation and response must occur at the local level. The Nation cannot achieve resilience without motivating and supporting local measures that achieve resilience through involvement of the whole community. Resources are needed to develop the human infrastructure for responding to and recovering from natural disasters, including dam failures. Understanding and planning for effective response after extreme events is a key part of developing community resilience. In FY 2012 and 2013, FEMA will focus on initiatives to help achieve community and regional resiliency within the framework of the multi-hazard environment.

Increase the Downstream Public's Awareness of Dams

Public awareness is an integral component of community and regional resilience. Many Americans are not aware that they are living downstream of a dam, much less a deficient dam. Many Americans also are not aware that they are living downstream of a deficient dam that does

not have an EAP to provide for warning and evacuation in the event the dam fails. In some cases, there is an EAP, but those living downstream are not aware of it. In FY 2009, FEMA developed and implemented initiatives to reach and inform the public and property owners of the existence of potentially deficient dams, ensuring that they are aware of the status of each dam. During the next reporting period, FEMA will continue to emphasize the importance of public outreach and awareness. FEMA will also analyze the results of the EAP marketing and outreach pilot project to determine how the successes of this effort can be replicated on a national level.

Increase the Number and Updates of EAPs

An EAP is one of the primary safeguards against the loss of life that can result from the failure of a dam. Today, about 34 percent of State-regulated high-hazard potential dams still do not have an EAP. Moreover, EAPs are not in place for all Federal high-hazard potential dams. FEMA and the dam safety community recognize that this is not acceptable. To address this deficiency, FEMA convened a standing Work Group on Emergency Action Planning in January 2009 to develop recommendations for significantly increasing the number of high-hazard potential dams with an EAP. The Work Group has developed a series of recommendations, strategies, and best practices for addressing EAP implementation at the State level. In FY 2012 and beyond, FEMA will pursue the initiatives recommended under the EAP Work Group's Action Plan to realize this most important goal for all high-hazard potential dams.

Assess the Risk Associated with Dams

This long-term priority for the National Dam Safety Program will continue. The number of dams in the United States identified as deficient is increasing at a faster rate than dams are being repaired. The Program can significantly reduce the risk to life and property from dam failures by providing State and Federal dam safety officials and dam owners with the tools to identify, prioritize, and mitigate this risk. In turn, information on the risk from dam failure must be shared with the downstream public. The Program will focus on this area through the analysis, development, and sharing of best practices and tools in risk assessment, with the ultimate goal of ascertaining the most efficient way to address risk assessment and the pursuit of research related to risk assessment. In FY 2010, FEMA also began to collect data from the States on the condition assessment of high-hazard potential dams.

Increase Inspections of Dams

One factor behind the increase in the number of dams identified as in need of remediation is the increase in inspections being performed, combined with better inspections and better reporting of inspection results. In January 2006, the Review Board approved a performance measure for the Program to increase the number of high-hazard potential dams in the United States that are inspected.

Increase Trained Stakeholders

This reporting period, more than 3,000 stakeholders were trained at dam safety workshops, seminars, and courses across the United States. An initiative for the next reporting period is to develop a balanced, comprehensive, cost-effective, and forward-looking program of technical and non-technical training for diverse audiences, including engineers; dam inspectors; dam

operators; dam owners; Federal, State, and local regulators and administrative staff; policy makers; business owners and homeowner groups; State and local emergency managers; and State and local emergency responders. As part of its leadership responsibilities, FEMA convened a Dam Safety Training Summit in 2011 to gather stakeholder input for a National Dam Safety Training Plan. This Training Plan will be aligned with the new Strategic Plan for the NDSP for FY 2012 through 2016.

Translate Research Products into Training and Expand the Research Program

The majority of research projects approved for Program funding generate a research product, such as a technical manual or guideline, which is based on priorities established in the 5-year Strategic Plan for Dam Safety Research. A goal of FEMA is to implement a better cross-walk between the research products generated and the training offered to stakeholders. In FY 2010, FEMA convened a Research Summit and a Research Workshop to develop a new 5-year Strategic Plan for dam safety research and to identify emerging priorities. One of FEMA's goals is to expand the research program from its focus on Federal research into procedures and engineering techniques to include areas such as the analysis, development, and sharing of best practices in risk assessment and the development of tolerable risk guidelines. The Research Strategic Plan also will be aligned with the new Strategic Plan for the NDSP.

Achieve the Participation of all States in the Program

Alabama is the only State not participating in the Program. A long-standing goal is for the State of Alabama to enact legislation so that it can participate in the Program.

Appendix A: List of Acronyms

ARS	Agricultural Research Service
ASCE	American Society of Civil Engineers
ASDSO	Association of State Dam Safety Officials
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CIKR	Critical Infrastructure and Key Resources
CIPAC	Critical Infrastructure Partnership Advisory Council
CTS	Consequence-Based Top Screen
DHS	Department of Homeland Security
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DSAT	Dam Sector Analysis Tool
DSES	Dam Sector Exercise Series
DSPMT	Dam Safety Program Management Tools
DSPPM	Dam Safety Program Performance Measures
DSS-WISE	Decision Support System for Water Infrastructural Security
EAP	Emergency Action Plan
EMI	Emergency Management Institute
EMPG	Emergency Management Performance Grants
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIMA	Federal Insurance and Mitigation Administration
FSA	Farm Services Agency
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
HEC-HMS	Corps Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Corps Hydrologic Engineering Center-River Analysis System
HHP	High-Hazard Potential
IBWC	International Boundary and Water Commission
ICODS	Interagency Committee on Dam Safety
IP	DHS Office of Infrastructure Protection
MSHA	Mine Safety and Health Administration
NDSP	National Dam Safety Program
NID	National Inventory of Dams
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NWC	National Watershed Coalition
OSM	Office of Surface Mining
PDM	Pre-Disaster Mitigation
PPD	Presidential Policy Directive
RHS	Rural Housing Service

Risk MAP.....	Risk Mapping, Assessment, Planning
RUS.....	Rural Utilities Service
S&T.....	Science and Technology Directorate
SSA.....	Sector Specific Agency
TADS.....	Training Aids for Dam Safety
TVA.....	Tennessee Valley Authority
USDA.....	U.S. Department of Agriculture
USFS.....	U.S. Forest Service
USGS.....	U.S. Geological Survey
USIBWC.....	U.S. Section, IBWC

Appendix B: Summary Status of Dams for Federal Agencies

Table 3: Summary Status of Dams for Federal Agencies (FY 2008-2009)

DEPT	DAM INVENTORY				PERIODIC INSPECTIONS				INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAPS	
Agency	Total	Hazard Classification			Total	Since Last Report			'08-09	Active	'08-09	Active	High	Sig.
		High	Sig.	Low		Formal	Inter.	Spec/Const.						
USDA (Total)	28462	2413	2631	22387	15078	1377	10591	3110	94	650	67	57	1191	177
ARS	1	1												
USFS (Owned)	547	40	109	398	121		96	25	12				40	15
USFS (Regulated)	580	140	273	167										
NRCS	27254	2233	2299	22722	14957	1377	10495	3085	82	650	67	57	1151	162
RHS	25													
RUS	25													
DoD (Total)	952	542	161	241	574	322	242		5	29	18	26	523	100
Corps	669 ¹	500	133	31	459	235	224		3	25	1	26	478	79
Army	230	35	20	175	91	73	18				16		32	16
Navy	31 ²	5	3	20	17	17			2	2	1	1	13	
Air Force	22	2	5	15	7	7				2	1			5
DOE	14	2	1	11	14	14							3	1
DOI (Total)	2700	485	125	2090	825	426	171	153	123	45	22	19	469	114
BIA	895	102	29	764	71	30	40	130 ³	19	19	3	8	88	28
BLM	609	8	1	600	110			110 ³	5		5	1	7	1
Reclamation	476	332	38	106	266	76	76	446 ³	87 ⁴	19	8	1	332	38
FWS	214	15	20	179	76	21	55	35 ⁵	4	4	5	5	15	18

DEPT	DAM INVENTORY				PERIODIC INSPECTIONS				INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAPs	
Agency	Total	Hazard Classification			Total	Since Last Report			'08-09	Active	'08-09	Active	High	Sig.
		High	Sig.	Low		Formal	Inter.	Spec/Const.						
NPS	436	17	26	393	25	23		2	8	3	1	4	16	20
OSM	69	10	11	48	276	276							10	9
USGS	1	1			1			1					1	
FERC	2524	771	195	1558	4520	427	3426	366	127	259	56	99	769	191
IBWC	7	3	1	3	358	1	357		2				3	1
MSHA	2529	360	238	1931	9343		9343 ⁶		26		10		174 ⁷	75
Coal	626	216	63	347	3272		3272		15		4		127	3
M/NM	1903	144	175	1584	6071		6071		11		6		47	72
NRC	9			9	9	9								
TVA	49 ⁸	36	10	3	134 ⁹	41	72	21 ¹⁰	7 ¹¹	4	1 ¹²	1	49 ¹³	

¹Five Corps dams need to have a hazard classification determined.

²Three Navy dams need to have a hazard classification determined.

³Annual inspections are included in count: BIA (129 annual inspections), BLM (110 annual inspections), and Reclamation (332 annual inspections).

⁴Reclamation includes Corrective Actions and Issue Evaluations (risk analysis) as Investigations and Studies.

⁵Inspections are performed by the Service station personnel on a continuing basis. The Service performs quality assurance and construction administration activities on an ongoing basis for all dams and dam construction activities.

⁶Inspections performed by engineers and by mine inspectors with training to recognize signs of instability and other potentially hazardous conditions.

⁷MSHA's standards for metal and nonmetal mines do not require EAPs; MSHA's standards for coal mines require provisions for evacuation of miners from mine property.

⁸Includes only main dam projects. Total, including associated saddle dams and dikes, is 84.

⁹Includes civil, mechanical, and electrical inspections. Number of monthly inspections (civil, mechanical, and diesel generator) by site staff is 1,140.

¹⁰Twenty one special inspections (not periodic) performed in FY 2008-2009 are included in the total.

¹¹The seven studies include Wilson Main Lock Gate Block (active); Kentucky and Pickwick Seismic Evaluations (Active); Consequences-Based Screening Procedure (Active); Little Bear Creek Dam Seepage Study; Ocoee 2 Stability Study; and Blue Ridge Seismic Evaluation.

¹²Bear Creek Rehabilitation Project.

¹³Saddle dams and dikes are included in main dam EAPs.

Table 4: Summary Status of Dams for Federal Agencies (FY 2010-2011)

DEPT	DAM INVENTORY				PERIODIC INSPECTIONS				INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAPs	
	Total	Hazard Classification			Total	Since Last Report			'10-11	Active	'10-11	Active	High	Sig.
		High	Sig.	Low		Formal	Inter.	Spec/Const.						
USDA (Total)	28462	2413	2631	22387	19444	1565	15106	2773	650	14	64	14	1508	177
ARS	1	1												
USFS (Owned)	547	40	109	398							13	6	40	15
USFS (Regulated)	580	140	273	167										
NRCS	27254	2233	2299	22722	19444	1565	15106	2773	650	14	51	8	1468	162
RHS	25													
RUS	55													
DoD (Total)	993	564	166	263	781	343	438		13	79	1	9	553	150
Corps	693	519	139	35	629	202	427		6	75	1	9	518	13
Army	248	36	20	192	130	11	11						35	15
Navy	29 ²	6	3	20	5	5			7	4			4	1
Air Force	23	3	4	16	17	17							1	4
DOE	14	2	1	11	14	14					1		2	1
DOI (Total)	2693	479	105	2109	1135	244	639	252	102	49	32	17	470	103
BIA	910	98	38	774	166	30	53	83	18	14	1	9	89	38
FWS	255	17	14	224	150	5	54	46 ^{2,5}	10	7	2		17	14
NPS	297	13	3	281	11	6	5		20		2	2	13 ³	3 ³
OSM	69	10	11	48	276	69	207						10	9
USGS	1	1			1			1					1	
FERC	2524	785	190	1549	4659	537	3403	719	180	306	53	161	785	190

DEPT	DAM INVENTORY				PERIODIC INSPECTIONS				INVESTIGATIONS & STUDIES		DAM SAFETY MODS.		DAMS WITH EAPs	
Agency	Total	Hazard Classification			Total	Since Last Report			'10-11	Active	'10-11	Active	High	Sig.
		High	Sig.	Low		Formal	Inter.	Spec/Const.						
IBWC	7	3	2	2	616	4	612		2	2	1		3	2
MSHA	1991	421	261	1309	7713				21				174	75
Coal	602	221	67	314	3946				19				111	4
M/NM	1389	200	194	995	3767				2				56	37
NRC	9			9	9	9								
TVA RO*	49 ⁴	36	10	3	172 ⁵	41	85	46 ⁶	1 ⁷	7 ⁷	1 ⁸	1 ⁹	49 ¹⁰	
TVA FGD&C**	41	1	22	11/4 ¹¹	96		13 ¹²	83					41	

¹Reclamation includes Corrective Actions and Issue Evaluations (risk analysis) as Investigations and Studies that are not under modifications.

²Inspections are performed by the Service station personnel on a continuing basis. The Service performs quality assurance and construction administration activities on an ongoing basis for all dams and dam construction activities.

³The NPS EAPs are interim EAPs and are not finalized.

⁴Includes only main dam projects. Total, including saddle dams and dikes, is 86.

⁵Includes civil, mechanical, and electrical inspections. Number of monthly inspections (civil, mechanical, and diesel generator) by site staff is 2,832.

⁶Twenty one special inspections (not periodic) performed in FY 2010-2011 are included in the total.

⁷Studies include Wilson Main Lock Gate Block; Kentucky and Pickwick Seismic Evaluations; Regional Probable Maximum Flood Studies; Regional Seismic Studies; Stability Studies; Gunterville Seepage Study; Concrete Growth Studies; and Consequences-Based Screening Procedure (Completed).

⁸Little Bear Grouting Project.

⁹Blue Ridge Penstock Replacement and Seismic Strengthening Project.

¹⁰Saddle dams and dikes are included in main dam EAPs.

¹¹Eleven low-hazard dams and four dams with a hazard classification TBD.

¹²Thirteen intermediate site inspections cover all 41 coal combustion facilities.

*TVA RO includes TVA river dams.

**TVA FGD&C includes TVA coal combustion facilities.