National Performance of Dams Program
An Archive of Dam Information and Experience

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Abstract
The National Performance of Dams Program (NPDP) was founded in 1994 and is located at Stanford University. It is devoted to the collection of current and historical information on the performance of dams for the purpose of supporting dam engineering and safety. The archive, coupled with an ongoing evaluation of dam performance data, provides a national capability to monitor the state of the nation's dams that can contribute to the advancement of dam engineering, and can support effective dam safety policy.

Introduction
One of the most fundamental elements of engineering is the practice of observing and learning from the in-service performance of constructed facilities. The notion of 'trial-and-error' learning has been a critical part of how builders and designers assess what works, what doesn't, and how things can be improved. Even today, with advanced analysis tools and sophisticated testing facilities, we continue to rely on direct observations and recordings of facility performance under different loading and environmental conditions to best understand how systems perform.

Unfortunately, failure plays a significant role in the advancement of engineering (Petroski, 1985) and is too often the motivator for bringing necessary change to engineering practice and public policy. In the case of dam safety, it took multiple failures in the 1970's (Buffalo Creek, 1972; Teton Dam, 1976; Kelly Barnes, 1976; and numerous others) to begin making dam safety a national priority. Even with these disasters as motivators, this only began the process of devoting resources to maintaining a safe dams infrastructure. It took another 20 years before we could say we have a 'National Dam Safety Program'.

While failures are often a motivator for change, ongoing monitoring of in-service performance (both successes and failures) provides the greatest opportunity to sustained improvement in engineering, construction, materials, assessing rates of deterioration, and identifying pre-cursory evidence of severe or developing problems.

Over the years, dam engineers have from time-to-time chronicled dam incidents and failures (Middlebrooks, 1953; Babb and Mermel, 1968; ICOLD, 1974, ASCE/USCOLD, 1975, 1988, ICOLD, 1994, among others). The NPDP is a formalization of this tradition. It is devoted to the ongoing collection and archiving of information on the performance of dams[2], and was founded for the primary purpose of making this archive available to professionals with an interest in the safe, and reliable design and operation of dams.

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[2] When the term 'dam' is used in this paper it is interpreted to mean the 'dam system' that is comprised of a number of man-constructed (embankments, etc.) and natural elements (foundation and abutments) that serve the structural and operational functions associated with water retention and hydraulic control.

This paper provides a review of the development of the NPDP, the archive holdings, and online database and tools.

Starting Out

The notion of a national archive devoted to the subject of dams was motivated in part by the earlier work of the U.S Committee on Large Dams (USCOLD), now the U.S. Society on Dams (USSD). Following an initial trial to assess whether dam performance data could indeed be gathered from state and federal agencies, efforts were initiated to establish a national library on dams. The NPDP was modeled as a 'special library', similar to the Earthquake Engineering Research Center library at U.C. Berkeley.

The founding principles for the NPDP and the gathering of dam performance data was developed by a group of dam safety professionals, organized with the support of the Association of State Dam Safety Officials (ASDSO), from the public (federal and state dam safety officials) and the private sectors. The committee, whose activities were funded by the Federal Emergency Management Agency (FEMA), addressed a number of basic questions related to the collection of dam performance data. These include: What is a dam incident? How should dam incidents be reported? What information is needed to document the performance of dams? The result was publication of the guidelines for reporting the performance of dams (NPDP, 1995; see also http://npdp.stanford.edu).

For the most part, not much has changed since the guidelines were developed. The one major change has been the growth of the Internet and the use of electronic documentation which allows for more efficient access to information and greater ease in reporting dam incidents.

Why Gather Data on Dam Performance?

One of the benefits of evaluating information from past experience is the opportunity to understand what design or construction practices did not achieve the reliable or efficient performance intended by the designer. An even greater benefit is the ability to identify pre-cursory signs/events that may signal future unsatisfactory or unsafe future performance.

In an age in which information technology provides tools for the efficient collection and distribution of information, the public and policy makers need and expect the ready availability of information-based guidance to support informed choices. To meet these needs it is important that a national capability exist to monitor and assess the state of the nation's dam infrastructure.

The national need for information that supports both day-to-day activities (i.e., scheduling of dam inspections) and long-term policies was initially recognized in the 1996 National Dam Safety Act, which called for a formal 'program of technical and archival research'. This need was further strengthened in the National Dam Safety and Security Act of 2002[3], which calls for the continued maintenance of a National Inventory of Dams and the 'development and

[3] Dam Safety and Security Act of 2002, P.L. 107-310.

Section 4. Research: Section 9(a)
The Director, in cooperation with the Board, shall carry out a program of technical and archival research to develop and support –
(1) improved techniques, historical experience, and equipment for rapid and effective dam construction, rehabilitation, and inspection;
(2) devices for the continued monitoring of the safety and protection of dams;
(3) development and maintenance of information resources systems needed to support managing the safety of dams; and
(4) initiatives to guide the formulation of effective public policy and advance improvements in dam safety engineering, security, and management.'

maintenance of an information resource system to support managing the safety and security of dams.'

There are numerous examples where information resource systems have been established in the public and private sectors. Examples include:

- Bureau of Transportation Statistics (transportation)
- University of Michigan (economics data)
- Centers for Disease Control (public health)
- Nuclear Regulatory Commission (commercial nuclear power)
- Cornell University (law)
- U.C. Berkeley (earthquake data)

In these and other examples, a commitment has been made to establish a system for gathering/submitting data and building an electronic archive, which is often coupled with an ongoing process of data evaluation that provides decision makers at policy and technical levels, consumers, and lawmakers with an information-based understanding and assessment of current and future trends.

A Case In Point

In 1995, a spillway gate failed at Folsom Dam in California during a 'normal' operation, resulting in a significant, uncontrolled release from the reservoir, and major economic losses. This event triggered considerable activity in the dam safety community, focused on the condition and operational integrity of spillway and outlet gate structures. This increased attention included detailed inspections, gate testing, structural evaluations, operational reliability, communications, and improvements in maintenance practices. Prior to Folsom incident, the attention to the structural and operational integrity of gates and other outlet systems was not nearly as comprehensive.

Was the Folsom gate incident unique? Or, had incidents involving the unsatisfactory performance of dam gates (operational or structural) occurred before? Were there pre-cursory events that may have highlighted the coming potential for a failure such as occurred at Folsom Dam? Table 1 lists a series of events involving the unsatisfactory performance of dam gates in the U.S. and internationally that occurred prior to the Folsom gate incident. In addition, in 1994 ICOLD published Bulletin 93 (ICOLD, 1994) which reviewed various types of dam incidents, including problems with gates and other discharge systems and offered recommendations with respect to gate design, construction and operation.

The events in Table 1 are a sample of dam gate incidents that occurred prior to 1995. The actual number is unknown. At the time of the Folsom incident there did not exist a practice in the profession of collecting data and assessing its relevance to dam safety.

In one sense the Folsom gate event is not unique – it is another example of an event that 'grabs' our attention, which then motivates us to pay closer attention to the subject at hand, albeit after the fact. However, experience in other fields (commercial aviation, automobile transportation, nuclear energy) suggests a more pro-active approach is prudent and necessary; including ongoing data collection, and an evaluation system that searches for early signs of future performance issues.

Since the Folsom gate incident, greater attention is now given to the condition of gates as a normal part of dam safety practice. As a result, it is reasonable to expect that a net benefit of

Table 1
Gate Incidents at Dams Prior to 1995

Dam Name	State/Country	Year	Event Description
Bonneville	Oregon	1945	Vibration damage to spillway gates.
Wanapum	Washington	1964	Spillway gate hoist failed to stop.
Belden	California	1966	A gate frame collapsed. The gate controls were inadvertently interchanged, thus when throttled releases went through the unvented gate, the steel liner collapsed and the concrete around the gate frame was damaged (USCOLD/ASCE, 1975).
Belden	California	1967	A steel liner collapsed, concrete failed and the gate seats were badly damaged (USCOLD files available at NPDP, 1973).
Picote	Portugal	1966	During a flood, a gate was being opened when a hoist chain became inoperable, leading to the failure of two hoist motors The gate dropped and experienced considerable damages (ICOLD, 1994).
Amistad	Texas	1976	During a gate operation, upstream roller intake gate rose, ultimately breaking a suspension cable (USCOLD files available at NPDP, 1973).
Milks Camp	South Dakota	1976	A hydraulic gate jammed in the open position allowing water to drain continuously (USCOLD files available at NPDP, 1973).
Coolidge	Arizona	1978	Drum gates failed to operate as a result of not being used in 45 years.
Jackson Lake	Colorado	1984	A spillway gate broke; ½ of a gate leaf missing.
Hatfield	Wisconsin	1993	Tainter gate hoist chain failure
Warm Springs	California	1995	Failure of a bulkhead gate hoist system during normal operations, resulting in dropping of the gate.

the Folsom gate failure is the improved condition of gates nationally, and increased reliability in their operation during normal operations, flood events or emergency operations. While such attention does not prevent any one incident, it is reasonable to expect that well-informed dam engineering professionals are better prepared to address potential vulnerabilities sooner rather than later. Further, it is also reasonable to expect that gates systems to be more reliable than have been in the past as a result of the attention we now give them following the Folsom incident.

Defining Dam Incidents

One of the key issues that was addressed when the NPDP was founded had to do with defining what is a dam incident. After considerable discussion, a straightforward definition was adopted (NPDP, 1995):

> *A dam incident is any event that provides insight to the structural and operational integrity of a dam.*

Table 2 gives a general list and description of dam incidents.

The term ‘incident’ which has been used for years in dam engineering (ICOLD, 1974; USCOLD/ASCE, 1975, 1988) has a negative connotation (e.g., unsatisfactory performance). Indeed, past publications on dam incidents have concentrated on events involving dam failure or other episodes of unsatisfactory performance.

Table 2
Dam Incidents

Event	Description
Inspection Findings	The findings of a dam safety inspection that identify unsatisfactory or unsafe conditions at a dam. These might include observations of deterioration, signs of distress or instability of a dam or appurtenant structures.
Dam Failure[4]	Any event resulting in the breach of a dam (partial or complete) and the uncontrolled release of the reservoir.
Controlled Breach	A planned (non-emergency, non-incident initiated) breach of a dam; possibly carried out to remove the dam from service or to make major repairs.
Downstream Release -- Controlled or Uncontrolled	Uncontrolled release of the reservoir (e.g., appurtenant structure misoperation), or controlled release with damage.
Inflow Floods, Earthquakes	The performance of a dam (satisfactory or unsatisfactory; anticipated or unanticipated) generated by a nearby seismic event or inflow flood.
Misoperation, Operator Error	Misoperation of appurtenant structures such as failing to comply with the project rule curve.
Equipment Failure	Failure of mechanical or electrical equipment to perform the functions for which they were intended.
Deterioration	Deterioration of concrete, steel, or timber structures that jeopardizes the structural/functional integrity of a dam or appurtenant structures.
Dam Safety Modification	Modifications to improve the safety of a dam or appurtenant structures such as might be required due to changes in design criteria. Note, repairs following an incident are reported as part of a follow-up to an incident.
Reservoir Incidents	Events that occur in the reservoir (e.g., landslides, waves) that may impact the safety of the dam.
Emergency Action Plans	Implementation of an Emergency Action Plan (or emergency actions) in part or whole.
Regulatory Action	The regulator has determined an unsafe condition exists, or the dam does not meet applicable design criteria (e.g., inadequate spillway capacity), and requires action to be taken by the owner (e.g., reservoir restriction, safety modification).

The NPDP definition suggests our interest is really much broader, and from an engineering and dam safety perspective more pragmatic. It includes any event that offers an opportunity to provide information/insight into the performance (structural, hydraulic, and operational) of a dam (anticipated or not; satisfactory or not). Events where satisfactory performance can be documented typically involve transient or on-demand events. Table 3 lists examples of the type of events where successful performance of dams can be documented. Successful performance is equally informative in assessing dam performance (what works vs. what does not).

The U.S. Department of Agriculture Soil Conservation Service (now the Natural Resources Conservation Service) used a similar approach while collecting and evaluating data on the performance of earthen spillways. Similarly, the USSD has compiled information on the performance, satisfactory and not, of dams during earthquakes (USCOLD, 1992; USCOLD, 2000).

[4] Dam failure refers to the uncontrolled release of the reservoir.

Table 3
Cases Where Satisfactory Performance of Dams Should Be Documented

Type	Events Involving Transient or On-Demand Events
Hydrologic Events	1. Dam overtopping 2. Emergency spillway overtopping above normal or typical levels 3. Operation of outlets (i.e., gates, valves, inflatable structures) 4. Structural performance of gates, etc.
Seismic Events	1. Strong-ground motion at a dam 2. Fault displacement occurring in the dam foundation or abutments 3. Seismically initiated waves in the reservoir (seiche) which impact or overtop the dam. 4. Waves initiated by seismically initiated landslides that impact or overtop the dam.
Emergency Action Plans	1. Any implementation of an emergency action plan (to any level); success (or failure) of communication systems, notification of downstream populations, etc. 2. Evacuation of the downstream population
Reservoir Waves	1. Wind-generated waves 2. Waves initiated by landslides

There are a number of benefits associated with documenting success, as well as failures. For instance:

- Events of satisfactory performance, of which there are many, puts failures and other episodes of unsatisfactory performance in perspective, quantitatively. Focusing on failures alone tends to bias one's perspective (i.e., the public, policy makers, etc.).
- A database that includes success and failure information provides a quantitative basis to assess the reliability of engineered systems.
- Success contributes to the validation of engineering design concepts, tools and processes.
- Documentation of success helps to build public confidence in dam engineering and operations.
- An event involving successful performance of a dam may also provide signs of limitations or short-comings in the design or operation of dams, or possibly the pre-cursory signs of incipient failure.

NPDP Library Holdings

As described above, the NPDP was founded on the idea that a special library devoted to dams and dam safety was needed to meet the needs of dam engineering professionals, policy makers, and the public. As such, a primary focus of the NPDP has been the collection of documents (reports, newspaper articles, books, technical papers, photographs, video, etc.) and not just the compilation of data for a database. Presently, the majority of the program's holdings are in hard copy. In recent years, more and more information is being submitted in digital form. In the future, as funding and resources permit, many of the older historic documents will be scanned so they can be viewed online.

Over the years, a number of special contributions have been made to the NPDP. These special holdings include:

- U.S. Committee on Large Dams dam incident surveys and supporting documentation
- U.S. Department of Agriculture Soil Conservation Service reports on the performance of earthen spillways as well as other dam incidents
- Federal Energy Regulatory Commission dam incident, failure and dam safety modification and repair database
- Engineering News & Engineering News-Record articles and letters to the editor and ASCE Transactions
- Ambursen Dam reports and technical papers
- The Corso Photo Files
- Thomas M. Leps personal library and professional documents

A brief summary of each is given below.

USCOLD (now USSD) – Historically, USCOLD and ICOLD have focused considerable effort on the collection and publication of information on dam incidents and failures (ICOLD, 1974, 1999, 2000; USCOLD, 1976, 1988, 2000). As part of the data collection activites that supported these publications, the USCOLD would typically send out surveys to dam engineers requesting information on dam incidents. In addition to specific questions, the surveys also asked for photographs, copies of documents, etc. The information provided in the response to these surveys was reviewed and formed the basis for USCOLD reports on dam incidents and failures (USCOLD, 1975 1988). In the mid-1990s, USCOLD donated these files to the NPDP, a volume equivalent to more than two file cabinets.

USDA SCS – For many years, the SCS made a practice of studying and documenting the performance of earthen spillways. Typically, these reports addressed the performance (satisfactory and not) of dams during the same hydrologic event. Each report included comprehensive documentation of the hydrologic event, detailed engineering evaluations, and descriptive documentation of the spillway performance. The SCS contribution includes original copies of these reports.

FERC – For many years, the FERC maintained a database of failures, incidents and dam safety modifications for projects they regulate. For each entry in their database (i.e., failure, incident and modification), the FERC staff provided an extended commentary on the events that took place prior to and during the event. In the case of dam modifications, the period of construction and project costs are also provided.

Engineering-News Record, etc. – For decades, Engineering News, Engineering Record, and later the merged Engineering News-Record was a place where in-depth articles and letters to the editor reported and discussed events of engineering interest. These pieces were often first-hand, spirited accounts by dam designers of incidents, failures, and the design process. Similarly, the ASCE **Transactions** pre-1970 often contain many long theses and arguments over individual dam incidents. A search of these publications at the Stanford engineering library identified articles on dam incidents which were copied and entered in the NPDP files.

Ambursen Dam Documents – Ambursen Dams are unique gravity structures designed by the Ambursen Hydraulic Company. As part of their work on these structures, Dick Rudolph (Xcel Energy) and Al Davis (formerly of GEI Consultants and now Alton P. Davis Consulting) have contributed a collection of publications to the NPDP on Ambursen Dams, including some from the Ambursen Hydraulic Company.

The Corso Photo Files – In the course of his career, Ron Corso, former director of the FERC's Division of Hydropower Dam Safety and Inspections, has also maintained a career as an amateur photographer. His photographic shortcomings not withstanding, Mr. Corso has amassed a respectable collection of photographs of dams, dam failures and incidents which he has donated to the NPDP. Currently, his photos of mill dams in the U.S. and abroad are available on the NPDP website (see Corso's Corner on the NPDP website at: http://npdp.stanford.edu).

Thomas M. Leps Personal Library and Professional Files - Recently, the family of Tom Leps, a well known and respected dam engineer, contacted the NPDP and offered to contribute Tom's personal library and documents related to his professional career. In all, this included approximately 160 boxes and 3 file cabinets of books, reports, technical papers, and thousands of photographs and slides.

NPDP Database System

The NPDP maintains a database system of dams, dam events and incidents. The system was built in an Oracle database that can be accessed from the NPDP website. Figure 1 shows a general schematic of the NPDP database. The dams and events in the NPDP relational database are uniquely identified by a dam identification number (the NATDAM ID as discussed below) and an Event ID. The development of the NPDP database was supported by a grant from FEMA.

Elements of the NPDP database system are summarized below:

NPDP Dams Directory – The NPDP Dams Directory is based on the National Inventory of Dams (NID) maintained by the U.S. Army Corps of Engineers. The NID is an inventory of dams that meet the NID criteria *and* dams that are currently operational. The Dams Directory uses the NID dam identification number (NATDAM ID) to identify all dams in our database, however, it differs in many respects from the NID. The NPDP Dams Directory includes:

- U.S. National Inventory of Dams
- Dams that pre-date the NID that the NPDP has dam performance information on (e.g., dams that failed and were not rebuilt - Teton Dam (1976), Buffalo Creek (1972)).
- Dams once included in the NID, but have since been removed, or failed and not rebuilt.
- Dams regulated by the states that are not included in the NID (i.e., do not meet NID size criteria)
- Any dam for which performance information (i.e., a dam failure) is reported to the NPDP that for whatever reason, is not included in the NID.

When a dam is added to the NPDP Dams Directory, which is not included in the NID and therefore does not have a NATDAM ID, the NPDP assigns an ID number that utilizes the format of the NATDAM ID with the introduction of an "S" following the state abbreviation; e.g.,

CA**S**00001[5], corresponds to a dam located in California that is not in the NID that has been entered into the NPDP Dams Directory.

In addition to these features, the Dams Directory must also maintain information on the characteristics of dams that change over time. This need arises in order to retain information on the characteristics of a dam when an incident occurs. For example, if a dam was overtopped and failed in 1965, and the spillway size was increased as part of the repairs in 1967, it is important that the spillway characteristics at the time of the event as well as the present spillway size be retained. As a result, the Dams Directory must maintain a record of dam characteristics, as this information becomes available.

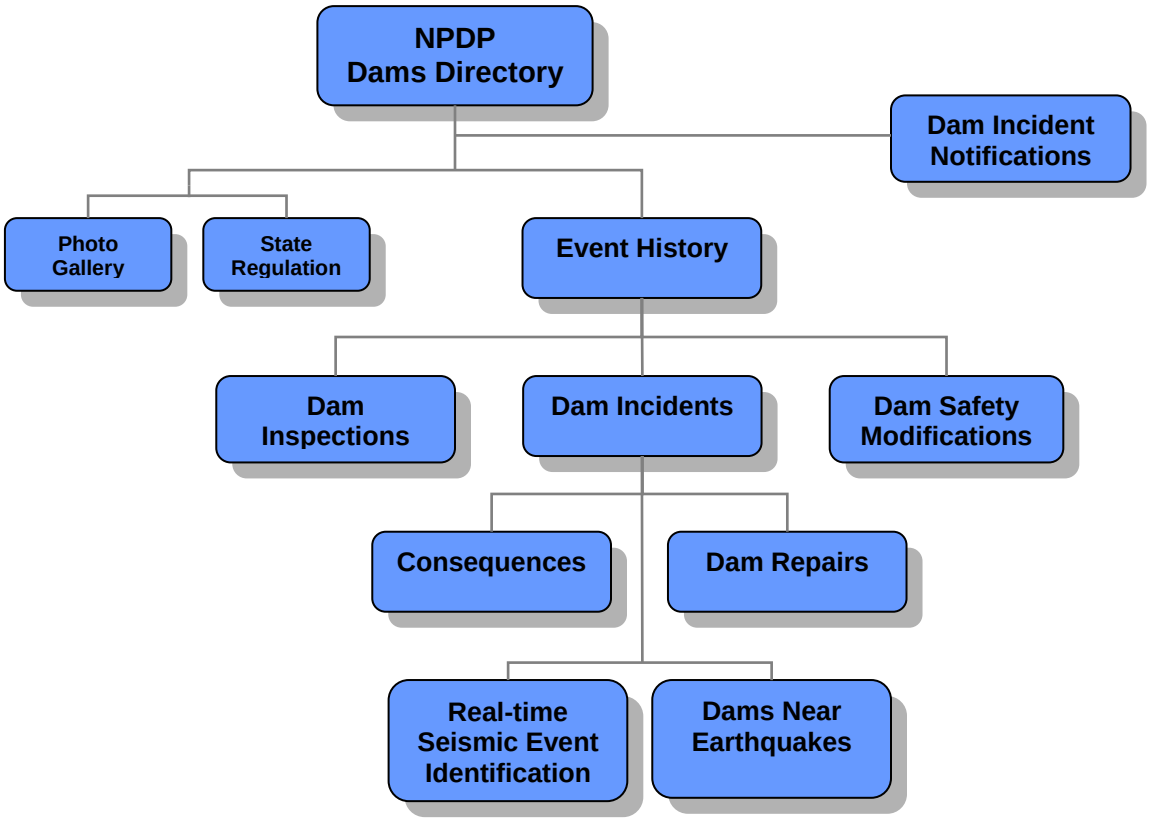

Figure 1 Schematic of the elements of the NPDP database.

Dam Incident Notifications – This database is maintained as a separate entity from the main database system. It is used to document the real-time events that are reported to the NPDP. Since the NPDP began, certain access limitations were imposed with respect to information on recent dam incidents[6]. For a period of one year, online or other requests for information on recent dam incidents are fulfilled without providing the name of the dam or any other information that could be used to identify the dam (e.g., NATDAM ID). The system was setup so that only the professional who reported an incident and the state dam safety officials for the state where

[5] The bold S is added here for emphasis.
[6] These limitations were developed by the committee of state, federal and private sector dam safety engineers that developed the NPDP dam incident reporting guidelines. The access limitation was instituted to avoid having the NPDP serve as a mechanism for a dam owner or state dam safety officials from being a target for information or other requests or inquiries.

the dam is located have access to identifying information. However, all users are provided access to all other information about reported incidents such as dam type, incident type, incident date, consequence information, etc.. As a result, all users can search the Dam Incident Notification database to search for all incidents of a given type, year of occurrence, etc.; only the names of the dams are restricted. Once an incident is a year old, or has been reported in the mainstream media, full access is given to all users.

Event History – As part of the NPDP database a general chronology of events that occur at dams is maintained. This chronology includes events of general interest (e.g., completion of dam construction) as well as dam safety events (e.g., dam failure). Examples of events in this data table include:

Construction Completion	All Dam Incidents (see Table 2)
National Dam Inspection Program Inspection	Recreational Accidents
Periodic Dam Safety Inspections	Vandalism
Dam Modifications – Safety and Non-Safety	Dam Retirement

For events of dam safety interest (e.g., dam inspection data, dam failure information, etc.), links are provided to the applicable data in the database. The event data is useful for the dam safety professional and others to review a general history of a dam.

Dam Inspections – As part of the database we have created a data table that allows us to summarize information, findings and recommendations from periodic dam safety inspections. Working with the format used by the Ohio dam safety program, the inspection data table lists dam safety findings and recommendations, and dam maintenance findings and recommendations, which are documented in inspection reports. Currently, data for dams in Connecticut and New Jersey inspections conducted during the National Dam Inspection Program are being entered into the database.

Dam Incidents – Each dam incident (see Table 2) is listed in a dam incident data table. Currently, this data table is populated primarily with dam failures. Each incident is identified with respect to its type, date of occurrence, etc., and a link for each dam that provides access to other information about the dam and incident.

Consequences of Dam Incidents – While the consequences of dam failure are of interest to the dam safety practitioner, the public, media, etc., historically the collection of this information has been incomplete (Boland, et al., 1980). As consequence information becomes available, it is entered into the database. Data on consequences that is maintained includes, fatalities, injuries, property damage, warning and evacuation information, emergency costs, etc.

Dam Safety Modifications & Repairs – Dam safety modifications and repairs are a significant part of dam safety. The NPDP database maintains information on both repairs and modifications. Repairs are defined as remedies for damage that has occurred as a result of an incident. Modifications are changes that are made to remedy a dam safety deficiency such as inadequate spillway capacity or seismic vulnerability (e.g., foundation liquefaction susceptibility). In practice, the line between repair and dam safety modification is often blurred, and thus the database does not strictly differentiate each of these activities as either a repair or a modification. The database includes a summary of the modification/repair type, the project cost, reason for the work performed, and a modification/repair description.

Reporting Dam Incidents

In the 'old' days (back in the 1990s) when the process of reporting dam incidents was developed, a series of steps were outlined that was predicated on the notion that available information would be submitted in hardcopy only. Needless to say, the 'hard-copy paradigm' has changed. We have now evolved to the point where documentation is available in electronic form and can be readily transmitted via e-mail or the NPDP website.

A mantra for reporting dam incidents has been and continues to be – dam incidents should be reported on the basis of information that is generated in the *normal course of dam safety activities or is readily available from existing resources*. The reporting process is not intended to create a new or additional documentation burden for dam safety professionals – other than the transmittal process itself (e.g., sending an e-mail with attachments).

There are three ways that dam incidents can be reported. These are:

1. NPDP Website – The NPDP website offers a simple way to report dam incidents online. The easiest way requires the user to identify the dam involved in the incident, provide the incident date, and to identify the type of incident. Further information can be supplied by simply uploading available documents.

   If digital documents are not available, and documents have not been mailed to us, online forms are also available to document aspects of an incident. However, use of the forms is optional. Besides the general inefficiency of forms, we prefer that available documents be forwarded, since they will likely contain more information than the online forms might request or can accommodate due to space limitations on the form itself.

2. e-mail – Users can report a dam incident by simply sending an e-mail to npdp_email@lists.stanford.edu attached files that document the incident.

3. Hardcopy – As always, sending a hard copy of available documents is an option. This may, in some cases, be the only means to forward drawings or other large documents, or in the case where electronic versions of documents are not available.

When a dam incident is reported, the information is reviewed and/or entered into the online database by the NPDP staff. Once this is done, the data are available for online users.

Accessing the NPDP Archive

There are two basic ways to access the NPDP database and archive, depending on the information that meets a user's need. These include:

1. Online Query - The NPDP website (http://npdp.stanford.edu) can be queried to view recently reported dam incidents, earthquakes that have occurred near dams, dam safety modifications and repairs, and historic dam failures and consequences.

2. Direct Communication Request - Users can also make their requests directly to the NPDP by e-mail, phone or fax. Often direct communication allows us to focus a users request and to make them aware of additional information that is in our library. In response to a direct request, we often provide an Excel spreadsheet that lists the incidents that fit the user's request. In addition a copy (hardcopy or digital) of documents are also provided.

Program Support
The NPDP has been supported by program affiliates and specific projects. The NPDP affiliates program is a university-sponsored program to support partnerships between industry, government, and research programs on campus. The affiliates program is a mechanism for the university to invest in university research programs and to promote collaboration with industry and government. Affiliate financial contributions, which are not burdened by the full university overhead charge, are used to support the program's day-to-day activities such as administrative staff, equipment purchase, dam incident report processing, library and database management and maintenance, data reporting, professional activities (e.g., participation in conferences), and ongoing data analysis. In addition to affiliate support, projects support specific research and development activities.

Summary
For over thirty years, there has been steady progress in national dam safety. Despite this progress, the need for and value of dam safety is not fully recognized or valued until disasters or near-disasters gain the attention of the public and policy makers. This past year alone has brought renewed attention to the vital role dam safety plays in managing our nation's dam infrastructure. The recent levee failures in New Orleans during Hurricane Katrina, the much watched, near-failure of Whittenton Dam in Tauton, Massachusetts, the failure of Hadlock Pond Dam in upstate New York, and the Taum Sauk failure in Missouri have each brought to the public's attention the role dam safety plays.

Recently, Matt Lindon of Utah noted,

> *"The Dam Safety industry has always been defined by its failures: Johnstown, St Francis, Baldwin Hills, Buffalo Creek, Canyon Lake, Teton, Laurel Run, Toccoa Falls and Quail Creek are names that are all too familiar. … We need to communicate what we do and how well we do it, in normal times as well as in times of crisis, to all our shareholders - including dam owners, downstream residents, supervisors and subordinates, FEMA and ASDSO, the legislature and the governor, the Congress and the President. …. Performance Measurement and Accountability are no longer MBA buzz words, they are a way of life in the private sector and now in public service where we are required to do more with less. Failures appear on the front page; successes appear on page 13." ….If we don't make a concerted effort to define our mistakes, our mistakes will continue to define us."*

Lindon's remarks point to a clear need to establish information resources from which informative measures of the state of dams and dam safety can be developed. These measures, which require a range of data to quantify, will provide the metrics that demonstrate levels and rates of progress, areas where improvement are needed, and pre-cursory signs as to where in the future we need to focus our attention. As other sectors involved in public safety and risk management have learned, there is significant value in gathering and evaluating information on the performance of our infrastructure systems (e.g., roads, bridges, rail, commercial air, public health system, etc.). Such efforts make it possible to support information-based (e.g., data-based) decision making at the technical as well as policy levels.

The NPDP looks to support dam safety in the effort to maintain a data-based awareness of the performance of dams such that the state of the nation's dams can be readily assessed, and signs of future problems can be identified and addressed before they contribute to future disasters.

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