1. About ASDSO
Join Us In Our Mission

ASDSO is the leading national non-profit association dedicated to dam and levee safety. ASDSO was created in 1983 in response to an urgent need for establishing and strengthening state dam safety programs and improving interstate communication about dam safety.

ASDSO works side-by-side with its members to build a unified community of dam and levee safety experts, recognized as leaders in their field; through the creation of industry standards and best practices; advocacy of legislative policy matters that impact the dam and levee safety community; educational opportunities to help members build upon their knowledge of core foundational topic areas, as well as the latest technology and practical trends impacting the profession; education of the general public on issues of concern for dam and levee safety professionals; and, support for future growth in the profession through outreach to students in grades K-12 and collegiate institutions to showcase the benefits of a career in dam and levee safety.

Becoming a part of the ASDSO community is a way to join with others to work toward advancing technology, standards, and the profession for a future where all dams are safe.

VISION: A future where all dams are safe.

MISSION: Improve the condition and safety of dams and lower the risk of dam failures through education, support for state dam safety programs, and fostering a unified dam safety community.
What Does ASDSO Do to Improve Dam Safety?

**SUPPORT**
state dam safety programs.

**EDUCATE**
dam owners and operators.

**DEVELOP**
a cohesive and engaged community committed to the ASDSO mission.

**INCREASE**
public awareness of the role of dams in society, the risks they present, and the importance of dam safety and preparedness.

**ADVOCATE**
for laws, policies, and government programs that serve to improve the safety of dams and reduce the risk to the public.

**ADVANCE**
and expand the technical expertise of dam and levee safety practitioners.

**STRENGTHEN**
and support a coordinated effort to improve the safety of dams and levees.

**PROMOTE**
innovative approaches to funding dam rehabilitation at the state and federal level.
2. Membership
Who Should Join ASDSO?

- State or Federal Dam Safety Officials
- Civil, Geotechnical, Environmental, and Structural Engineers
- Scientists and Technicians
- Dam Owners and Operators
- Service and Product Suppliers
- Engineering Consultants
- Academic Professors and Researchers
- Students
- Hydrologists/Geologists
- Emergency Management Professionals
- Floodplain Professionals
- Anyone with a concern for dam and levee safety issues
What can you gain by becoming an ASDSO member?

EXPAND YOUR KNOWLEDGE AND PROFESSIONAL EDUCATION

✓ Discounted access to ASDSO’s robust training program, including conferences, technical classroom courses, and webinars. New memberships include a complimentary On-Demand webinar to help you get started.

✓ Free access to an enormous amount of resource information through the ASDSO’s Dam Safety Resource Database. This includes all past and current ASDSO conference papers and journal articles.

✓ Keep up to date on current news and trends through the monthly ASDSO member e-newsletter.

✓ Receive a subscription to the quarterly Journal of Dam Safety.

GROW YOUR CAREER

✓ Professional Development through paper publication and presentation forums.

✓ Gain career knowledge and opportunities from relationships with peers and mentors.

✓ Opportunities to volunteer for ASDSO task groups and committees.

FORM A PROFESSIONAL COMMUNITY

✓ Collaborate, ASDSO’s professional networking site, provides an opportunity to connect with nearly 3,000 professionals through shared interests and advice.

✓ Build relationships with members in different sectors of the community, including owners, regulators, educators, and more.

✓ Opportunities to join or start interest groups.

BUILD A SAFER FUTURE

✓ Support knowledge sharing between different state dam safety programs, federal regulators, designers, and owners.

✓ Assist in developing outreach and best practice materials, including videos, guides, handouts, and webpages.

✓ Measure success by requesting a Peer Review of your dam safety program.

✓ Advocate for legislation and policies that strengthen national and state dam safety programs.

Through membership dues, you support ASDSO projects that directly give back and support the community at large.
Membership Information

The failure of dams and the great destruction and loss of life failures often cause, is a matter of deep concern to the members of the Association of State Dam Safety Officials (ASDSO). ASDSO serves state dam safety programs and the broader dam safety community, which includes federal dam safety professionals, dam owners and operators, engineering consultants, emergency managers, manufacturers, suppliers, academia, contractors, and others interested in improving dam safety. If you are interested in a world where all dams are safe, invest in the future of dam safety today by becoming a member of ASDSO.

» Learn more today at DamSafety.org/JoinASDSO
Membership Categories

INDIVIDUAL MEMBERSHIPS

Individual memberships provide membership benefits directly to the individual, including discounts on ASDSO training and conferences.

Individual memberships are non-transferable and due annually.

<table>
<thead>
<tr>
<th>Membership Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Standard</td>
<td>Individual dam owners, self-employed consultants, university personnel, and other individuals whose company is not an ASDSO member. Individual members who are employees of a company with an Organizational membership shall receive a 50% discount off the Individual Standard membership.</td>
</tr>
<tr>
<td>Individual Government</td>
<td>Open to all state, local, or federal government officials interested in dam safety.</td>
</tr>
<tr>
<td>Retired</td>
<td>Anyone who has been a member of ASDSO for 5 years or more, is fully retired from active employment, and is 55 years of age or older, or permanently disabled is eligible.</td>
</tr>
<tr>
<td>Student</td>
<td>Student member status shall be granted to an applicant enrolled at least part-time and not employed as a full-time professional. Student membership may be maintained only while actively enrolled in school, but for no more than five years.</td>
</tr>
</tbody>
</table>
ORGANIZATIONAL MEMBERSHIPS

These membership categories are for companies or individuals working for companies in the private sector. Individual members who are employees of a company with an Organizational membership shall receive a 50% discount off the individual standard membership. All Organizational members qualify for exhibit, sponsorship, and advertising discounts.

Organizational memberships are renewed on an annual basis.

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**Organizational Standard (formerly Affiliate Company)**

$420

One contact person is designated for each company membership, and company employees may join at a reduced employee rate (up to 12 per company membership).

**Educational Entity**

$305

This category provides an opportunity specifically for educational institutions to become members with up-to two professors receiving full member benefits, as well as students in applicable fields, and provides two on-demand webinars each year to the institution for educational use.

**Dam Owner Operator**

$420

Organizations who own/operate dams and are interested in furthering dam and levee safety. The membership benefit is provided to the organization. All Dam Owner/Operator Organizational memberships include one individual who receives benefits as the primary contact.
Small Scale Dam Owner
$116

Small organizations or property owners who own only one dam and are interested in furthering dam and levee safety. This would include farms, HOA’s, and other property owners whose dam is not power generating. The membership benefit is provided to the organization. All Small-Scale Dam Owner Organizational memberships include one individual who receives benefits as the primary contact.

Organizational Sustaining Member
$3,100

Any member may add visibility and value to their existing membership and assist in advancing ASDSO’s goals. Sustaining members receive substantially higher discounts on exhibit, sponsorship, and advertising opportunities, as well as premier visibility on DamSafety.org and other ASDSO events and publications.

Agency Sustaining Member
$3,100

Any governmental agency may add visibility and value to their existing membership and assist in advancing ASDSO’s goals. Sustaining members receive substantially higher discounts on exhibit, sponsorship, and advertising opportunities, as well as premier visibility on DamSafety.org and other ASDSO events and publications.
3. Program of Study
Program of Study

A ROADMAP FOR EDUCATING THOSE WORKING IN THE DAM SAFETY ENGINEERING COMMUNITY

All ASDSO webinars and classroom technical courses are selected by the ASDSO Training Committee made up of state dam safety officials, federal representatives, and members of the private sector. The work of the Training Committee is guided by the ASDSO Dam Safety Program of Study.

Its current form is the result of many meetings, workshops, and summits where experts determined what areas of education were necessary for dam safety engineers, dam safety regulators, and others to practice effectively. The current Program of Study includes 17 topic areas as well as a listing of corresponding national guidelines and best practices documents. It is continually updated by the ASDSO Training Committee and staff and can be viewed by visiting DamSafety.org/ProgramOfStudy.
4. Conferences

DAM SAFETY CONFERENCE PROCEEDINGS

Want to read past conference papers? The annual Dam Safety National Conference proceedings are available to all ASDSO members for download in the ASDSO Resource Database.
April 8-11, 2024
Southeast Regional Conference
Knoxville, TN

September 22-26, 2024
Dam Safety 2024
Denver, CO
The annual Dam Safety national conference is held each September. Dam Safety is the leading conference in the United States dedicated to dam safety issues and knowledge transfer. Dam Safety brings together over 1,000 dam and levee safety professionals with over 100 exhibitors and sponsors for a week of networking, education, and policy discussions.

» For additional details visit http://damsafety.org/ds24
Southeast Regional Conference

ASDSO regional conferences offer attendees the perfect opportunity to network with colleagues from across the region and learn from others who are working to keep dams safe. While the conference is geared towards dam safety engineers and dam owners/operators in the southeastern states, many topics are applicable to dam and levee safety professionals from across the country.

» For additional details visit https://damsafety.org/se24
5. Technical Seminars
2024 Calendar of Technical Seminars

January 23-25, 2024  • Virtual
Inspection and Assessment of Dams

February 6-9, 2024  • Virtual
Stability Analysis of Embankment Dams

March 5-8, 2024  • Virtual
HEC-RAS

April 2-4, 2024  • Tampa, FL
Improving Emergency Operations for Dam and Levee Failures and Incidents

May 21-23, 2024  • Denver, CO
HEC-RAS 2D

June 18-21, 2024  • Virtual
Seepage Through Earth Dams

July 16-19, 2024  • Virtual
Basic Soil Mechanics Related to Earth Dams

October 15-17, 2024  • CO
Dam Construction Inspection

November 6-8, 2024  • Virtual
Fundamentals of Reinforced Concrete
Technical Seminar Details

ASDSO Technical Seminars are provided throughout the year and are guided by the ASDSO Program of Study. Technical Seminars provide a multiple-day deep dive into their respective subjects.

The following listing is a comprehensive look at all current ASDSO Technical Seminars. Please note that not all seminars are on the 2024 calendar but could have a future offering.
Concrete Dams Design and Analysis

**INSTRUCTORS**  
Guy S. Lund, P.E., Gannett Fleming, Inc.

**OBJECTIVE**  
In large civil engineering projects, knowledge is a key characteristic of efficient and economical design, construction, and operation. When the level of knowledge falls, the conservative assumptions increase, and with an increase in conservative assumptions comes an increase in costs. Therefore, it is important to understand to the best of our knowledge the theories, experiences, and practices passed down by our predecessors so we can be better stewards of the infrastructure.

This seminar will strive to educate professionals in the engineering practice of concrete dams. There will be example problems, which will require participants to perform simplified concrete gravity dam analysis (using Excel spreadsheets), and then use the results to evaluate the safety of the structure. In this manner, the participants will gain experience in the practice of concrete dam engineering.

**KEY TAKE-AWAYS**  
- Link historical design philosophies to current practices in concrete dam design.
- Review past failures and incidents.
- Summarize the typical loads and load combinations applied to concrete dams.
- Develop Potential Failure Modes (PFMs) for concrete dams and learn how to use analysis results to assess PFM development.
- Review dynamics, understanding earthquake loads and behavior.
- Learn about surveillance and monitoring considerations and concerns.
- Introduce risk related to concrete dams.

PDHS 19
**Dam Construction Inspection**

**INSTRUCTORS** Terry Arnold, P.E., Henrik Forsling, P.E., and Bill Snyder, AECOM

**OBJECTIVE** This course serves as an introduction and guidance on construction oversight and inspections associated with the construction or modification of a dam and appurtenant structures.

**KEY TAKE-AWAYS**
- Organization, communication, and the roles, responsibilities, and authority of project team members.
- Emergency operations for dam and levee failures and incidents.
- Importance of dam construction documentation and record-keeping.
- Understanding design limitations and dealing with unexpected conditions during construction.
- Construction observation and inspection considerations for dam construction.
- Good and bad construction examples, things to watch for, and dealing with things that go wrong.

**PDHS** 14

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**Dam Design, Plans, and Specifications Review**

**INSTRUCTORS** Terry Arnold, P.E., Mike Zusi, and Casey Robertson, AECOM

**OBJECTIVE** This course will be an interactive seminar that provides a well-blended mixture of lecture presentations covering various design disciplines along with several strategically designed hands-on exercises that provide interaction among participants. The exercises will be developed to include review of documents for a dam rehabilitation project to provide experience to both the novice and experienced dam safety engineer with design review. This course has been developed to provide attendees with a broader background on dam design and specific experience and resources that can be used following the seminar.

**KEY TAKE-AWAYS**
- Dam design, state of the practice.
- Standards and guidelines review.
- Design documents.
- Civil 3-D design to 2-D plan development.
- Incorporating Potential Failure Modes Analysis (PFMA) in the design process.
- Plans/Drawing review.
- Specification development and review.
- Design details and construction specifications to achieve constructability and meet quality control requirements of the design.

**PDHS** 14
Earthquake Engineering for Embankment Dams

**INSTRUCTORS** Lelio H. Mejia, Ph.D., Glenn J. Rix, Ph.D., P.E., and Christie Hale, Ph.D.; Geosyntec Consultants, Inc.

**OBJECTIVE** The objective of this course is to provide instruction on the general subject of earthquake engineering of embankment dams. The course will begin with a historical perspective on dam performance during earthquakes and an overview of basic concepts about earthquakes. The course will then progressively address more specialized subjects including a) evaluation of seismic hazard and characterization of earthquake motions for dam design, b) field investigation methods and characterization of materials for seismic analysis, c) methods for analysis of dynamic response and seismic stability of dams, d) procedures for instrumentation and post-earthquake inspection, e) considerations pertinent to risk analysis, and f) defensive design measures. The lectures will include presentation of case histories pertinent to some of the subjects covered in the course.

**KEY TAKE-AWAYS**
- Understanding of the basic aspects of earthquake engineering of embankment dams.
- Primary lessons from the seismic performance of embankment dams during past earthquakes.
- Familiarity with inputs required to perform a seismic hazard analysis and how the results are used in seismic safety assessments of dams.
- Understanding of the basic elements of dynamic response and seismic stability analysis of embankment dams.
- Introduction to risk analysis concepts for embankments including potential failure mode analysis and likelihood and consequence assessment.
- Familiarity with primary aspects of defensive design measures for seismic loads.

Fundamentals of Reinforced Concrete

**INSTRUCTORS** Randall P. Bass, P.E., James R. Crowder, P.E., and John P. Harrison, P.E., Schnabel Engineering

**OBJECTIVE** This course is intended as an introductory course for persons who have at least one course in reinforced concrete design. The course will provide a thorough overview of the fundamentals of specifying the fresh and hardened properties of concrete mixes; the review of applicable codes for concrete hydraulic structures; the design philosophy and methodology of reinforced concrete hydraulic structures; and issues associated with the construction process. The course will include actual design examples of frequently used hydraulic structures utilizing current design codes and guidelines that are focused on reducing cracking, limiting deflections, increasing durability, and decreasing permeability.

**KEY TAKE-AWAYS**
- Understand what influences the fresh and hardened properties of reinforced concrete.
- Learn the design codes and loadings unique to the design of hydraulic structures.
- Learn how to design a durable hydraulic structure that is resistant to degradation, undermining, and destabilizing uplift pressures.
- Be able to review concrete design reports, specifications and drawings of non-complex structures for errors and omissions.
- Review construction means and methods affecting the performance of hydraulic structures.
HEC-HMS with Application to Dam Safety

INSTRUCTORS
Amanda J. Hess, P.E., CFM and Gregory Richards, P.E., CFM, Gannett Fleming, Inc.

OBJECTIVE
Participants will gain practical knowledge of methods for simulation of runoff from storm rainfall. The methods covered relate to the processing of historical and hypothetical (design-storm) rainfall data; estimation of losses (infiltration); transformation of rainfall excess to direct runoff with unit hydrographs; routing of flood waves; calibration of model parameters; and modeling of runoff from watersheds. Experience will be gained in applying the methods with the program Hydrologic Modeling System (HEC-HMS). Where possible, applications will emphasize hydrologic computations for dam safety.

KEY TAKE-AWAYS
• Methods to simulate runoff from storm rainfall.
• Estimating hydrologic abstractions and transforming excess rainfall using unit hydrograph theory.
• Evaluating dam and reservoir performance during flood events.
• Running the HMS model on several real-world problems.
• Estimating uncertainty in modeling runoff.

PDHS 21

HEC-RAS

INSTRUCTORS
Amanda J. Hess, P.E., CFM and Gregory Richards, P.E., CFM, Gannett Fleming, Inc.

OBJECTIVE
This course is an introduction to HEC-RAS with applications to dam safety. The introduction course provides a hands-on opportunity to use the program and resolve specific questions. The objective of this course is to review the basic principles of open channel hydraulics as they relate to the natural stream environment with application to dam safety. Bridges, culverts, and in-line structures will be discussed and both steady and unsteady flow modeling will be explored.

By the end of the participant will be able to apply these six objectives and have a comfort level in developing and analyzing a hydraulic model for typical open channel flow applications. The participants should have an undergraduate engineering degree.

KEY TAKE-AWAYS
• Understand the basics of water surface profile computations.
• Create 1D HEC-RAS models.
• Incorporate bridges, culverts, and in-line structures.
• Apply principles of open channel flow to dams and dam failures.
• Extract and analyze output.
• Obtain an understanding of 1D unsteady flow modeling with HEC-RAS.

PDHS 22.5
**HEC-RAS 2D**

**INSTRUCTORS** Patrick Miles, P.E., Jeremy Dixon, P.E., CFM, Camilo Cristancho, P.E., Freese & Nichols, Inc.

**OBJECTIVE** This is an interactive seminar focused on the application and benefit of two-dimensional flow capabilities of HEC-RAS, specific to the dam safety industry. The course will maintain a balance between lecture-style presentations on model theory and hands-on workshop sessions for examples of model applications. Topics will include applications and benefits of HEC-RAS 2D modeling; RAS Mapper and terrain preparation; running 2D models including dam, levee, and breach modeling; viewing results with RAS Mapper; troubleshooting and model review. The course will also cover new features released with recent updates to HEC-RAS, such as spatial precipitation and infiltration; 2D bridge hydraulics; improvements to RAS Mapper; and more. The course will utilize the most recent version of the HEC-RAS software available at that time.

It is recommended that attendees have some HEC-RAS 1D unsteady experience. ASDSO's HEC-RAS Course is a recommended prerequisite. It is recommended that attendees have some HEC-RAS 1D unsteady experience.

**KEY TAKE-AWAYS**
- Understand when and where to use HEC-RAS 2D.
- Develop necessary input/terrain data for HEC-RAS 2D.
- Create and run a HEC-RAS 2D model.
- Troubleshoot and review a HEC-RAS 2D model.
- Utilize HEC-RAS 2D for various dam safety applications.

**PDHS 19**

**Improving Emergency Operations for Dam and Levee Failures and Incidents**


**OBJECTIVE** This is an interactive course designed to help participants learn about key tools that will help improve emergency preparedness and enhance communication during dam and levee failures and incidents. Participants will gain a better understanding of the emergency action planning process, including evacuation planning and emergency response methods.

**KEY TAKE-AWAYS**
- Learn how to improve the integrated operations between dam owners, emergency planners, first responders, and dam engineers.
- Understand the basic potential failure modes for dams and levees.
- Understand the basics of integrated operations under the Incident Command System.
- Understand how to prepare, test, and improve emergency action plans.
- Learn how to improve communications during dam and levee incidents.
- Understand how to improve evacuation planning.
- Learn about new technologies that can help improve your emergency response.

**PDHS 19**
ASDSO 2024 Training & Education Catalog

Seepage Through Earth Dams

INSTRUCTORS  
John France, P.E., D.GE, D.WRE, JWF Consulting LLC; Jennifer Williams P.E.; and John Cyganiewicz, P.E., Cyganiewicz Geotechnical, LLC.

OBJECTIVE  
This introductory course is designed to be a participatory, interactive workshop, which will cover the basic elements required to understand and evaluate seepage-related issues for earth dams. The first day begins with providing an understanding of why seepage mechanisms in earth dams are important to dam safety. Information on seepage mechanics, including permeability and erodibility will then be presented. The conclusion of the first day and beginning of the second day will focus on the basic principles and characteristics of seepage related to embankment dams, various modes of seepage, and computational methods for evaluating seepage. The conclusion of the second day and beginning of the third day will focus on methods of investigating, controlling, and remediating dam seepage. Discussions on various case studies will conclude the third day. Hands-on exercises will represent real-world, practical applications pertinent to the attendees. The final half day will include a hands-on, introductory session of the SEEP/W computer program to demonstrate computational analysis of hypothetical seepage scenarios for an embankment dam.

KEY TAKE-AWAYS  
- Why understanding seepage mechanisms in earth dams is important to dam safety.
- Principles and characteristics of seepage related to embankment dams, including review of potential seepage-related failure modes and their common initiators or triggers.
- Computational methods for evaluating seepage.
- Understanding theory, application, and design of filters.
- Methods of investigating, monitoring, controlling, and remediating seepage problems in existing dams using case histories and hands-on exercises to enforce understanding of practical applications.

PDHS 19

Inspection and Assessment of Dams

INSTRUCTORS  
Paul G. Schweiger, P.E., and Dean B. Durkee, Ph.D., P.E., Gannett Fleming, Inc.

OBJECTIVE  
The seminar provides comprehensive instruction in inspection and evaluation techniques for dams. The principles, concepts, and procedures taught will be readily adaptable to any organization conducting dam inspections and evaluating their compliance with current design standards. Participants learn about a variety of dam types and their appurtenances, the function of typical dam features, and common dam failure modes and the conditions that can lead to these failure modes. Actual dam failure cases will be presented. Public safety, security, and liability will also be discussed along with approaches to responding to dam incidents.

KEY TAKE-AWAYS  
- Historical perspective of dam construction methods for various dam types.
- Common failure modes associated with various dam types.
- Understanding of standards for maintaining dams.
- Techniques for performing a comprehensive dam inspection.
- Awareness of emerging issues related to inspection and assessment of dams.

PDHS 19
Spillway Erodibility Investigation & Analysis

INSTRUCTORS
Stantec Consulting Services, Inc.

OBJECTIVE
To safely provide controlled release of water from reservoirs, spillways are critical components to the safety of downstream populations. Spillway erosion is a component of many potential failure modes resulting from large floods and spillway discharges, and unfortunately, many spillway incidents and failures have occurred over the years. This course will provide engineers and dam safety professionals with a broad understanding of spillway erosion, with presentations focused on the fundamental concepts and applications of hydrology, hydraulics, scour and erosion, and evaluation of spillway erosion. Relevant case studies will also be presented. Instruction of the NRCS SITES software will be integrated into the training and course participants will work through training exercises utilizing the software. Guest lectures will be provided by additional experts to give a broader understanding of this important topic.

Relevant case studies will be integrated into the core topics associated with hydrology, hydraulics, scour and erosion mechanisms, soil and rock erodibility, field evaluation, and intervention and emergency planning.

KEY TAKE-AWAYS
• Learn about processes and controls associated with erodibility of unlined spillways.
• Review available data, analytical tools, and skills required for evaluation of spillway stability.
• Understand NRCS SITES modeling software through presentation, demonstration, and class exercises.
• Assess results of spillway erosion modeling that will be put into context of spillway assessment and potential remediation evaluation.

Stability Analysis of Embankment Dams

INSTRUCTORS
John W. France, P.E., D.GE, D.WRE, JWF Consulting LLC; Kevin Ritter, P.E., AECOM; and John Rice, Ph.D., P.E., G.E., Utah State University

OBJECTIVE
This course provides broad coverage of stability analysis for embankment dams. Topics addressed in the course include soil stress-strain behavior, shear strength selection, field and laboratory testing methods, slope stability analysis methods, slope stability analysis loading cases, seepage as related to stability analysis, and stability rehabilitation methods. The course includes several exercises to reinforce the information presented in lectures, as well as two optional evening sessions providing opportunities for hands-on experience with a commonly used slope stability computer program.

KEY TAKE-AWAYS
• An understanding of the importance of slope stability in dam safety, and the basic theoretical principles supporting slope stability analysis methods.
• An understanding of the significance of adequate subsurface characterization and shear strength property selection.
• An understanding of soil stress-strain behavior and its relationship to shear strength.
• An understanding of how to select shear strength parameters from field and laboratory data.
• An understanding of slope stability rehabilitation measures.
LIVE WEBINAR SERIES

Join ASDSO every second Tuesday of the month for our live webinar series.
2024 Webinar Calendar

**January 9**
Why People Die During Flood Events and Options for Reducing Future Flood Fatalities

**February 13**
Triaxial Lab Testing for Earth Dams

**March 12**
Intrusive Activities in Dams and Levees – Are They Worth the Risk of Creating a Flaw?

**April 9**
Modeling Tailings Dam Failures with 2-Phase Flow

**May 14**
Preventing Fatalities in Confined Spaces at Dams

**June 11**
Construction Quality Control / Information Data Systems for Dam Rehabilitation

**July 9**
Facilitating Low-Head Dam Removals and Improving Aquatic Resource Restoration Outcomes

**August 13**
Using the Cone Penetrometer Test (CPT) for Evaluation of Dams and Levees

**September 10**
Hydraulic Tour of Standard NRCS Inlet Risers

**October 8**
Tools for Designing and Assessing Spillways

**November 12**
Best Practices in Floodplain Management Associated With Dam Safety Management and Dam Rehabilitation

**December 10**
TBD
2024 Webinar Details

ASDSO offers live webinars each year. All webinars are selected by the ASDSO Training Committee and align with the ASDSO Program of Study. Live webinars provide the valuable opportunity for real-time interaction with the instructors, who can answer questions through the live chat feature. In addition, individuals who register for the live broadcast may also access the On-Demand version of the webinar following the live broadcast. Live webinars also allow registered participants to complete the quiz at the end and receive the PDH credit.

INTERESTED IN PRESENTING AN ASDSO WEBINAR?

Use the ASDSO Webinar Application to submit a webinar topic to be reviewed by the Training Committee.
Why People Die During Flood Events and Options for Reducing Future Flood Fatalities

INSTRUCTOR
Jason T. Needham, USACE

OBJECTIVE
This webinar will describe what we know about why people die during flood events and opportunities to reduce flood fatalities during future events. Results from analysis of over 100 location-specific fatalities will be provided to lay the foundation for understanding what leads to life loss during dam breach, levee breach, coastal, and riverine flood events. This webinar will describe a modern approach for estimating potential loss of life from flooding and show how emergency management activities can be used to reduce it.

KEY TAKE-AWAYS
• Understand why people die (or not) when coming in contact with flood water (direct life loss).
• Understand why people die due to circumstances associated with major flood events, even when not coming in contact with water (indirect life loss).
• Overview of LifeSim, a modern tool for estimating potential loss of life from flooding.
• Understand factors that influence the effectiveness of an evacuation effort.
• Learn about a set of tools for reducing potential loss of life from flooding and other hazards.

PDHS
2
MEMBER RATE
$99
NON-MEMBER
$130

Triaxial Lab Testing for Earth Dams

INSTRUCTOR
Ronaldo Luna, PE, PhD, D.GE, Saint Louis University/Luna Consulting LLC

OBJECTIVE
The triaxial test is the premier laboratory test to evaluate shear strength conditions for earthen embankment dams. This test is common practice in geotechnical engineering but requires a good understanding of the different laboratory steps and procedures. This webinar will present concepts of the triaxial test as it applies to embankment dams. Different stages of a triaxial test such as specimen preparation, saturation, consolidation, and shearing will be discussed in detail. The different types of tests available (UU, CU, CD) for the different loading conditions during the life of an earthen dam will also be discussed. The application of different triaxial tests for different situations will be explained for practical situations in the field.

KEY TAKE-AWAYS
• Understand the fundamental principles of triaxial testing of soils.
• Understand how to use the control of drainage to develop different types of triaxial testing.
• Understand how to obtain shear strength parameters for design or rehabilitation of earth dams.

PDHS
2
MEMBER RATE
$99
NON-MEMBER
$130
Intrusive Activities in Dams and Levees – Are They Worth the Risk of Creating a Flaw?

INSTRUCTOR Thomas Terry, P.E., P.G., USACE Institute for Water Resources, Risk Management Center

OBJECTIVE The U.S. Army Corps of Engineers has updated its regulation ER 1110-1-1807, Drilling and Invasive Activities at Dams and Levees, and related guidance based on what has been observed and learned during the last nine years of reviewing drilling program plans. This webinar will describe the update, which includes expansion to cover invasive activities for all dam and levee structures such as concrete dams and flood walls. The webinar also presents a different way to think about the risks related to drilling and invasive activities related to dams and levees, along with a short primer on hydraulic fracturing calculations related to fluids in borings. The processes and concepts presented are applicable to all dams and levees.

KEY TAKE-AWAYS
- Updates to Drilling and Invasive Activities at Dams and Levees (ER 1110-1-1807).
- Learn about problems that have occurred during drilling and lessons learned.
- Understand how a risk-informed perspective on invasive activities and their related flaws might change your views on these activities.
- Gain a better understanding of the basics of hydraulic fracturing and how to estimate related factors of safety.
- Understand why cavity expansion theory is not appropriate for hydraulic fracturing related to dams and levees.

PDHS 2
MEMBER RATE $99
NON-MEMBER $130

Modeling Tailings Dam Failures with 2-Phase Flow

INSTRUCTORS Jimmy O’Brien, Ph.D., P.E., Karen O’Brien, MSc., and Noemi Gonzalez Ramirez, Ph.D., P.E., RIADA Engineering, Corp

OBJECTIVE This webinar will focus on the following:
- Failure modes of a tailing dam. Discussion of recent tailings dam failures.
- Use of Tailings Dam Tool and regression equations to estimate volume releases.
- Simulate tailings dam breach including tailings material and water volume using a two-phase flow model.
- Predict downstream mudflow inundation.
- Simulate mudflow – fluid exchange with scour and deposition, downstream tributary inflow and mudflow into lakes and reservoirs.
- Predict sediment routing by size fraction, and mudflow cessation and re-mobilization.
- Set up a project using QGIS and the FLO-2D model. Application of the Tailings Dam Tool.
- Mudflow Hazard Mapping.

KEY TAKE-AWAYS
- Understand potential failure modes of tailing dams.
- Learn about basic data and key factors for tailing dam failure modeling.
- Simulate tailing dam failures using a two-phase flow model.
- Review mapping and analysis of results.

PDHS 2
MEMBER RATE $99
NON-MEMBER $130
Preventing Fatalities in Confined Spaces at Dams

Paul Schweiger, P.E., and Joseph Bell, Gannett Fleming, Inc.

Most dams have facilities that include permit-required confined spaces. These spaces can include towers, risers, galleries, manholes, vaults, conduits, instrument enclosures, tunnels, adits, drainage systems, etc., that are often unmarked and possess several unique hazards to dam inspectors, operators, and trespassers that are not intuitively obvious without confined space training. Unfortunately, several dam inspectors, contractors, and operators have recently lost their lives while working in and around confined spaces at dams. In addition to the tragic loss of life, the dam owners and others responsible for conducting work at these dams were subject to significant litigation and payment of fines. In almost all cases, the experience drastically changed the policies and practices of these dam owners and organizations, including the implementation of mandatory training of their staff, clearly marking confined spaces as hazardous areas, and restricting access to these spaces.

The professionals tasked with designing, inspecting, or working in or around confined spaces at dams should have training to help them identify permit-required confined spaces and to know how they need to be treated. Before performing a manned inspection of a permit-required confined space at a dam, a confined space entry plan should be developed that includes advanced notifications, assigned inspection team responsibilities, use of special equipment, and following well-established confined space entry protocols.

The purpose of this webinar is to provide dam safety professionals an introduction into permit-required confined spaces at dams and the challenges and special requirements that these spaces entail. The importance of this topic will be reinforced using case histories at dams that included loss of life and near-tragedies. Factors to be considered before entering a confined space will be discussed along with recommendations for training personnel, needed equipment, and the preparation of a confined entry plan. These and other lessons learned will be shared to serve as a helpful resource for dam safety professionals.

KEY TAKE-AWAYS
- Learn about permit-required confined spaces and where they most commonly occur at dams.
- Gain an awareness of confined space incidents that have occurred at low head dams.
- Understand how permit-required confined spaces need to be treated at dams.
- Overview of best practice techniques for safely entering permit-required confined spaces.
- Overview of available resources for confined spaces at dams.

Construction Quality Control / Information Data Systems for Dam Rehabilitation

Conrad Ginther, Andrew Higgins, and Jamey Rosen, Geosyntec Consultants

We live in an information age. A huge variety of digital tools and methods are in use to assure quality in dam construction. These tools can be leveraged to verify compliance with specifications, excavation limits, production rates, construction limits, structure size, geotechnical instrumentation trends, and generate as-built records much more efficiently than manually compiled and analyzed data. This webinar will look at the use of digital tools in managing the enormous amount of data generated by a project. As a result, construction quality and compliance with design intent can be ascertained in real time and inform decisions that must be made in a timely manner to minimize delays and project impacts. Tools for automated record keeping and as-built drawings will be explained along with data management both during the project and at construction’s end.

KEY TAKE-AWAYS
- Identify digital tools and approaches available to assist with dam construction.
- Understand how to manage incoming data during construction.
- Understand how to leverage available data during construction to evaluate elements of work outside of specifications.
- Review reporting, records, and final data storage.
- Review case histories that demonstrate leverage of data management tools.
Facilitating Low-Head Dam Removals and Improving Aquatic Resource Restoration Outcomes

INSTRUCTORS
Jeffrey Hartranft and Josh Fair, PA Department of Environmental Protection

OBJECTIVE
Many low-head dams no longer serve their original purpose and their existence often poses a public safety risk and continues to have negative impacts on aquatic resources. This webinar will focus on effective strategies for low head dam removal and aquatic resource restoration in Pennsylvania over the last two decades, which may also facilitate dam removals in other states. Topics will include applied principles of aquatic ecosystem restoration and technical aspects of restoration planning, design, and implementation for low head dam removals. More in-depth topics on recent regulatory program adaptations and interpretations for current and future low head dam removal and aquatic resource restoration efforts will be presented. Case studies will present low head dam removal monitoring results and recent scientific and technical advances that are being applied to current aquatic resource restoration efforts. Technical aspects that apply to geologic, engineering, environmental, hydrologic, geomorphic, and many aquatic resource restoration disciplines, particularly stream and wetland-focused disciplines, will be included. Lastly, funding opportunities will be discussed with an emphasis on regulatory compliance through mitigation banking, in-lieu fee, and water quality obligations.

KEY TAKE-AWAYS
• Understand Pennsylvania’s regulatory authorities and interpretations that have facilitated dam removals and that may be useful to apply in other state and federal regulatory programs.
• Learn about effective regulatory processes to engage stakeholders and aid in dam removal efforts.
• Discuss technical planning, design, and implementation for improved aquatic resource restoration outcomes, particularly natural aquatic ecosystem forms and processes for streams and wetlands.
• Learn how to identify and address degradation through an analysis of watershed and site histories.
• Understand natural restoration targets at dam removals for multiple aquatic ecosystem components, including integrated stream and wetland complexes within the floodplain.
• Learn about funding sources for dam removals, including mitigation banking, in-lieu fee programs, and water quality obligations.

Using the Cone Penetrometer Test (CPT) for Evaluation of Dams and Levees

INSTRUCTOR
Rick Olsen, PhD, P.E., TrustDirt.com

OBJECTIVE
This webinar will comprehensively cover the Cone Penetrometer Test (CPT) from the most basic ideas to advanced topics. It will be engaging, interesting, and enjoyable to watch. The most important concepts will be fully described. There will be numerous examples of state-of-the-art evaluations. Stratigraphy evaluation is an underutilized potential for the CPT, and examples will be presented. A significant capability of the CPT is the ability to track continuous critical soil layers (soft clays for static conditions and loose sands for seismic events) under dams and levees. Various methods for stratigraphy evaluation will be presented. Numerous simple techniques will be given for evaluating paper-based plots of CPT data versus depth. The economics of CPT will be fully described, including how it relates to borings, sampling, index testing, and lab strength testing. Methods and techniques for CPT prediction of clay strength, sand friction angle, and liquefaction potential will be fully explored and compared.

KEY TAKE-AWAYS
• Learn how to plan a comprehensive CPT investigation for high economic return.
• Understand how the CPT predicted Soil Characterization index is related to soil type and soil type-based behavior.
• Learn about simple tools, methods, and software for evaluating CPT data to predict soil strength and other geotechnical properties.
• Understand how over-consolidation (OCR) influences CPT measurements and predicted soil behavior.
• Learn how to use CPT-predicted sand type and measured piezometric pore pressure for risk-based assessment of earth dams, levees, and tailing dams.
Hydraulic Tour of Standard NRCS Inlet Risers

INSTRUCTORS
Dhan Gautam, Ph.D., P.E., Karl Visser, P.E., and Hong Wang, Ph.D., P.E., USDA-NRCS

OBJECTIVE
This webinar will describe USDA-NRCS riser inlets for watershed dams. USDA-ARS research on various riser configurations informed the current standard NRCS riser design. Other NRCS inlet risers exist for specific design situations. Maintenance concerns for continued optimum riser performance will be discussed. Finally, this webinar will explore how NRCS criteria protects earth spillways by requiring separation between the riser crest and auxiliary spillway crest.

KEY TAKE-AWAYS
• Learn how field performance and ARS research have shaped the NRCS standard Dx3D riser.
• Understand hydraulic considerations for sizing a standard NRCS riser.
• Select NRCS design hydrographs for evaluating riser performance.
• Discuss riser capacity interaction with earth and structural auxiliary spillways.
• Learn about typical NRCS riser maintenance considerations.

INSTRUCTORS
Greg Richards, P.E., CFM, and Seth Thompson, P.E., SPRAT I, Gannett Fleming Inc.; and Brian Crookston, Ph.D, P.E., UT State University/Water Research Laboratory

OBJECTIVE
Spillways are complex hydraulic structures with materials and geometries that are often tailored to unique site conditions. As such, the analysis associated with the design and assessment of spillways needs to be commensurate with the complexity of the structure and the risk posed by the structure. Some of the complex hydraulic issues often considered at spillways include approach conditions, control section performance, discharge capacity, submergence, cross waves, training wall heights, cavitation potential, joint stagnation pressures, erosion/rock scour, and energy dissipation. Tools to address these issues range from empirical methods to various types of models. Deciding which method of analysis to use is key to having a successful project that efficiently meets the intended performance criteria.

This webinar will discuss in detail these issues related to spillway hydraulics and provide an overview and comparison of available design and analysis tools including empirical methods, numerical models, and physical models. The applicability of computational fluid dynamics (CFD) and/or physical models as well as the data requirements, costs, and schedule requirements associated with each will also be discussed. Example projects will be used throughout.

KEY TAKE-AWAYS
• Gain perspective of the various types of spillway and energy dissipation structures and the hydraulic issues that need to be addressed when designing and assessing them.
• Understand the current best practices of spillway hydraulic design and assessment.
• Develop a foundational knowledge of the available industry-accepted design and analysis tools for various spillway and energy dissipation structure types.
• Learn the advantages and disadvantages of 3D CFD modeling compared to physical modeling.
• Understand when a spillway requires higher order analysis tools such as a 3D CFD model or a physical model.
**November 12**

**Best Practices in Floodplain Management Associated With Dam Safety Management and Dam Rehabilitation**

**INSTRUCTORS**
John Wolfhope, P.E., Freese and Nichols and Sam Crampton, Dewberry

**OBJECTIVE**
This webinar provides an overview of the history, recent trends, and best practices in floodplain management as relates to dam safety management, with a special focus on dam rehabilitation and FEMA's High Hazard Potential Dam (HHPD) Rehabilitation Grant Program.

**KEY TAKE-AWAYS**
- Document history and development of floodplain management practices and approaches in the US.
- Identify opportunities for stakeholder collaboration in improved floodplain management.
- Propose best practices for floodplain management associated with dam rehabilitation.
- Identify funding opportunities related to floodplain management and dam rehabilitation.

**PDHS**
2

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**December 10**

**TBD**

**INSTRUCTORS**
TBD

**OBJECTIVE**
TBD

**KEY TAKE-AWAYS**
TBD

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2

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ALPHABETICAL LISTING

Webinars below are listed in alphabetical order. Please note, instructors are listed with the organization to which they belonged during the presentation of the webinar.

The 1979 Machhu Dam Disaster: Social Origins and Social Consequences

INSTRUCTORS Utpal Sandesara, Resident in Internal Medicine, UCLA; Tom Wooten, Ph.D. Student, Harvard University Department of Sociology

OBJECTIVE In this webinar, Utpal Sandesara and Tom Wooten will discuss their book, No One Had a Tongue to Speak: The Untold Story of One of History’s Deadliest Floods. The course will cover the social causes and social consequences of the 1979 failure of the Machhu Dam-II in Gujarat, India. The flood wiped out dozens of villages and the industrial city of Morbi, killing at least 5,000 people. The course will cover the technical causes of the dam failure, the managerial problems that allowed design flaws to go unchecked, and the many ways the flood upended lives in the Machhu River Valley.

3-D Effects on Estimation of Gradients, Seepage Flows and Evaluation of Internal Erosion Potential Failure Modes

INSTRUCTOR Keith A. Ferguson, P.E., National Practice Leader, Dams and Hydraulic Structures, HDR Engineering, Inc.

OBJECTIVE This webinar will present the results of 2D and 3D numerical evaluations of seepage conditions around a developing piping defect. An updated model similar to the first 3D numerical model performed at the University of Florida beginning in about 1980 (Townsend, 1981) will be presented to illustrate the importance of 3D influences on estimated seepage gradients, seepage flows and the evaluation of potential internal erosion potential failure modes. The updated numerical models were developed using the computer code SVFlux. One of the benefits of this program is an automatic remeshing routine that provides for more accurate estimation of seepage gradients in areas of seepage concentration such as at a discharge defect (influence on initiation processes), or as a pipe continues (progresses) in an upstream direction toward the reservoir or water source. A simplified method of estimating 3D influences on gradients and flow quantities will be presented that will allow practitioners to evaluate several different shapes and sizes of dam and levees.

Advances in Geologic Data Collection and 3D Geologic Modeling for Site Characterization and Safety Studies for Dams and Levees


OBJECTIVE This course will address a variety of geologic issues in dam and levee design and safety engineering, with emphasis on the application of 3D geologic modeling and other technologies to enhance communication between the project geoscientists and the project engineers, regulators, and other stakeholders.

Analysis of Concrete Arch Dams

INSTRUCTOR Guy S. Lund, P.E., Gannett Fleming, Inc.

OBJECTIVE The purpose of this course is to provide a brief introduction into the science of concrete arch dams. The review will touch on design methods used in the past, but primarily focus on the methods used in the current state of the practice. A historical review of construction techniques will be discussed, and how that relates to evaluations and the physical behavior of the structures. The basic loads and loading conditions used for analysis will be explained, as well of techniques that can be used to validate analysis models.

A Perfect Storm of Flawed Judgments and Decisions

INSTRUCTOR Robert A. Kline, Jr., P.E., Gannett Fleming, Inc.

OBJECTIVE Through various venues such as ASDSO’s DamFailures.org website, many in the dam engineering community today know the basic story of the Bayless Dam failure that occurred over 100 years ago in the small town of Austin in north-central Pennsylvania. The dam failed on September 30, 1911, resulting in the loss of 78 lives. In the immediate wake of this disaster, investigations to identify the contributing factors to this concrete dam failure were hastily prepared to quickly appease the public with answers. Limitations in the technological advancement of dam engineering at the time further prevented a comprehensive understanding of the failure’s contributing factors.

Despite technological shortcomings, perhaps the most troubling aspect of this event is the fact that the disaster could have easily been prevented if warning signs had been correctly interpreted and there had not been a cascading series of flawed judgments and decisions over a span of more than two years. It also illustrates why effective dam safety regulatory programs are so important. This webinar will revisit the lessons learned from both a physical and human factors perspective in hopes of providing a sobering reminder of how immature technology coupled with one or more unchecked flawed judgments and decisions, made by people who lack adequate technical expertise, can result in catastrophic consequences. Given that newsworthy dam failures have recently occurred which also likely involved flawed judgments and decisions, and which were preventable, it is evident that the profession still needs to learn from history to prevent future dam failures.

Application of 2D Hydraulic Modeling for Dam and Levee Safety

INSTRUCTORS Amanda J. Hess, P.E., CFM, and Benjamin P. Israel-Devadason, P.E., CFM, Gannett Fleming, Inc.

OBJECTIVE Recent improvements in the computational capacity of computers and in the availability of high-quality terrain data have allowed 2D hydraulic models to become highly valuable tools in dam and levee safety analyses. Today, there are several free and commercially available 2D models on the market. This webinar will provide a background on 2D hydraulic modeling theory, identify steps to set up a 2D model, describe important specifications for 2D models, and summarize features available in 2D models. Applications of 2D models for dam and levee safety will be highlighted.
Application of PFMA in Dam Safety

INSTRUCTOR Douglas D. Boyer, P.E., CEG, Federal Energy Regulatory Commission

OBJECTIVE Failure mode evaluation, or what is now more commonly referred to as potential failure mode analysis (PFMA) for dam safety, has become routine practice for many in the profession. The process became more formally organized by the US Bureau of Reclamation in the early to mid-1990’s and gained wider industry exposure in the early 2000’s through the publication of FERC’s Engineering Guidelines, Chapter 14 – Dam Safety Performance Monitoring Program. The PFMA process systematically identifies, describes, and evaluates ways a dam and its appurtenances could fail under all postulated loading conditions. However, a PFMA is much more than an exercise to evaluate and document potential failure modes for a dam. At its fullest extent, a PFMA is a valuable tool which can be used to guide and inform dam safety personnel on where to focus dam safety observations and inspections, where to strategically perform an investigation or install instruments to monitor dam performance, and can be used as a first step in a risk analysis. The process and results of the PFMA can also help to identify and prioritize O&M deficiencies, identify the need for improved operational processes, and pinpoint training needs. PFMAs can benefit dam owners and regulators by providing a better understanding and appreciation of potential structural and operational weaknesses and operating procedures. Finally, they may also be used to better inform downstream emergency management personnel of the hazards posed by the dam, while also providing a better understanding of effective evacuation protocols.

Application of Risk Principles within State Dam Safety Programs

INSTRUCTOR Greg Richards, P.E., CFM, Gannett Fleming, Inc.

OBJECTIVE The application of risk-informed decision-making to dam safety in the United States has been considered since the 1960s. However, it wasn’t until the mid-1990s that risk-informed processes and criteria were seriously applied to dam safety by both the Bureau of Reclamation and U.S. Army Corps of Engineers. Since that time, many other federal agencies have adopted risk-informed processes and Federal Guidelines for Dam Safety Risk Management has been published. Within state dam safety agencies, however, the adoption of risk-informed decision-making has lagged. There are many likely reasons for this delay including limited resources, difficulty in updating regulations, lack of technical training, and in some cases skepticism of engineers and regulators in adopting a new approach to dam safety. At present, most state dam safety programs still follow a prescriptive, standards-based approach for dam design criteria. Contrary to this trend, there have been several states (including Colorado, Washington, Montana, and New Mexico in particular) that have applied or are in the process of developing simplified risk-informed processes to dam safety. These vary from using risk information to define regulatory Inflow Design Flood criteria to facilitating potential failure mode screenings and risk assessment workshops for individual dams. Simplifications have allowed regulators and dam owners with limited resources to take advantage of risk information in making dam safety decisions. This webinar will discuss the history of risk-informed processes in the United States, provide an overview of risk-informed decision-making processes that are currently being applied within state dam safety programs, and highlight several recent risk initiatives that these states are pursuing. The perspectives of current dam safety officials from these states regarding the challenges and opportunities posed by risk analysis will also be shared.

Automated Instrumentation and Early Warning Systems for the Monitoring of Dams

INSTRUCTOR Lee Mauney, PE, CFM, HDR Engineering, Inc.

OBJECTIVE Timely warning and rapid response have proven to be critical in reducing consequences during dam and levee safety incidents. The detection of abnormal, hazardous, and/or threatening conditions is the first step in issuing a more timely and effective warning. Early Warning Systems can provide real-time information on the health of a dam, conditions during incidents, and advanced warning to evacuate ahead of dam failure flooding. An Early Warning System is an Automated Data-Acquisition System (ADAS) equipped to transmit and process data to include early warning notification features and programmed to operate without the need for human intervention. The system may include various types of sensors, including reservoir/saline water level monitoring, stream gauges, geotechnical/structural instruments, and weather measurements; however, a successful Early Warning System program encompasses much more than just instrumentation and offers numerous potential benefits for a dam/levee safety program.

Best Management Practices for Waterstop Selection, Installation, and Inspection

INSTRUCTORS Joseph Kudritz, P.E., and Brian Afek, P.E., Michael Baker International, Inc.

OBJECTIVE This course is intended to provide guidance on the proper selection and installation of waterstops for hydraulic structures. This course will discuss the various types and applications of waterstops and discuss the necessary design constraints such as site constraints, joint types, head pressures, and concrete clearances and cover. The course will emphasize the need for thorough structure detailing to ensure proper clearances and placement location are specified. The use of 3-dimensional modeling techniques will be discussed as a visualization technique to better detail complex joints. Most deficiencies regarding waterstops occur with the installation of the waterstops. Therefore, this course will highlight proper and improper installation placements and welding techniques. The course will discuss the benefits of using manufacturer welded unions, having properly trained waterstop installers, input from the waterstop manufacturer, and having trained inspectors.

Best Practices for Dam Safety Warning Signs

INSTRUCTORS Diana Castro, Atkins and Preston Wilson, FEMA.

OBJECTIVE FEMA’s Dam Safety Warning Signs Best Practices is a compilation of existing leading practices from industry leaders to provide nationwide guidelines for consistent signage to improve public safety around dams. Through this webinar, attendees will learn about the importance of dam safety signage, how to assess the risks at dams that can be addressed by safety signage, and several best practices for materials, messaging, and maintenance for dam safety signage.

Cracking and Hydraulic Fracturing in Embankment Dams and Levees

INSTRUCTOR Deborah J. Miller, Ph.D., P.E., Miller Geotechnical Consultants

OBJECTIVE Cracks are likely to develop in most embankment dams and levees, and not just in those that are poorly constructed. This course will present some of the common conditions that can lead to adverse geostatic stress conditions, cracking, and hydraulic fracturing in embankments. Case histories are used to illustrate various crack-forming mechanisms and potential failure modes associated with
embankment cracking. The need for caution when considering drilling in the core of a dam is discussed. The course will review practical design measures that can be implemented to defend against internal erosion that is associated with the inevitable formation of cracks in dams and levees.

**Concrete Construction – Issues and Remedies**

**INSTRUCTORS** Mike Zusi, P.E., and Henrik Forsling, P.E., AECOM

**OBJECTIVE** Spillways and outlet works are critical structures to the operation of a dam, and each of these features has its own unique design detail and construction requirements. Even the best and most experienced contractors don’t always get it right.

This webinar will focus on the most commonly encountered construction defects for each of the respective structures and how to address them. The presenters will begin with an introduction of key design features to provide design basis and context for potential remedies. They will then present detailed examples of defects and challenges often encountered in hydraulic structure construction. The presenters will further discuss proactive measures that can be taken to reduce the occurrence of these construction defects and to mitigate the effects thereof. Finally, the presenters will discuss how to identify defects, understand their root causes, assess their criticality, and present the current best practices of typical remedies and repairs.

**Concrete Repair and Maintenance for Dams**

**INSTRUCTOR** Kurt F. von Fay, Bureau of Reclamation (Retired)

**OBJECTIVE** This course will provide an overview of the best methods and materials for concrete repair and maintenance. It will include a description of a systematic process to follow to achieve best results and will include information from recent industry wide research efforts to ensure long lasting durable repairs. Attendees will learn how to conduct a thorough condition assessment, the most common types of concrete damage, how to select the correct material for repair, proper substrate preparation, and how to repair leaks and cracks.

**Current Trends in the Seismic Analysis of Embankment Dams**

**INSTRUCTOR** Lelio Mejia, Ph.D., P.E., G.E., Geosyntec Consultants Inc.

**OBJECTIVE** Earthquakes represent a significant hazard to dams in many parts of the United States and the world and are a key consideration in the safe design and construction of dams. A key aspect of earthquake risk mitigation for dams is reliable seismic analysis of the expected performance of dams under earthquake loads. Significant advances have been made by the dam engineering profession in the seismic analysis of dams over the past several years. This webinar will provide an overview of the fundamentals of seismic analysis of embankment dams and discuss current trends in the analysis of seismic stability and deformations. The webinar will provide dam engineers and dam safety officials with basic knowledge of seismic analysis of embankment dams and an overview of recent developments in analysis methodologies for the seismic safety evaluation of such dams. Topics to be covered include lessons from observed performance during past earthquakes, selection of appropriate analysis procedures, evaluation of soil behavior and strength, and procedures for analysis of seismic stability and deformations. Key concepts will be presented for each topic with application examples of selected concepts in practice.

**Dam Construction Quality Control – Do’s, Don’ts and Lessons Learned**

**INSTRUCTOR** Randall P. Bass, P.E., Schnabel Engineering

**OBJECTIVE** The implementation of a successful dam design is predicated on the construction contractor using acceptable construction means and methods when performing the work and the quality control staff performing timely and through inspections. There are many critical work items associated with dam construction which, if not performed correctly, will lead to poor performance, reduced service life, and contribute to potential failure modes. This webinar will present some proper and improper construction techniques that are often encountered during dam construction that are crucial to a successful project including, engineered fill placement, internal drains systems, reinforced concrete structures, RCC placement, control of water, and foundation preparation. Participants of this webinar will gain greater knowledge of acceptable construction practices, understand the consequences of out of spec work, and better understand how to evaluate the inspect critical work tasks during dam construction.

**Dam Overtopping Protection Systems - Part I**

**INSTRUCTOR** Tom Hepler, Schnabel Engineering

**OBJECTIVE** This is the first of a two-part series on overtopping protection systems for embankment and concrete dams. Many dams today have insufficient spillway capacity and may be overtopped during large floods below the regulatory requirement. In recent years, dam overtopping protection has become increasingly popular to provide additional flood release capacity when more conventional methods such as increasing spillway discharge capacity or reservoir storage are cost prohibitive or impractical. This course will present many of the overtopping protection systems currently in use, describing for each their range of design applications, construction considerations, and potential limitations and risks. Using FEMA’s 2014 Technical Manual: Overtopping Protection for Dams as a guide, the two most commonly used systems today, roller-compacted concrete (RCC), and articulating concrete blocks (ACB) will first be presented, followed by various reinforced concrete, turf, and rockfill alternatives for embankment dams. The course will conclude with special applications for concrete dams. Part 2 explores the performance of various systems in hydraulic model studies.

**Dam Overtopping Protection Systems - Part II**

**INSTRUCTOR** Christopher Thornton, Ph.D., Colorado State University

**OBJECTIVE** This is the second of a two-part series on overtopping protection systems for embankment and concrete dams. Many dams today have insufficient spillway capacity and may be overtopped during large floods below the regulatory requirement. In recent years, dam overtopping protection has become increasingly popular to provide additional flood release capacity when more conventional methods such as increasing spillway discharge capacity or reservoir storage are cost prohibitive or impractical. This course will present the process of evaluating protections systems for use in spillway applications. A summary of determining appropriate project hydraulic conditions will be followed by a brief history of prototype research conducted on multiple types of protecting technologies. Results of these tests will be presented in support of design methodologies where new methods for determining project FOS and numerically evaluating hydraulic jump system performance will be recommended. Procedures outlined in NRCS NEH Part 628 Chapter S4, “Articulated Concrete Block Armored Spillways” will be presented to show a standardized evaluation approach whereby permitting evaluation of multiple protection system technologies. The presentation will conclude with an example of a design application.
**Dam Safety with 3D Weirs**

**INSTRUCTORS** Brian Crookston, Ph.D., P.E., and Greg Paxson, P.E., Schnabel Engineering

**OBJECTIVE** Inadequate spillway capacity, significant hydrologic loadings on embankments and structures, and operation and maintenance are common dam safety issues, instigating the need for risk-reduction measures and/or rehabilitation. 3D weirs, or weirs with a crest length greater than the spillway width, are a particularly efficient approach to reduce these concerns. These weirs are also commonly used in new dams and may be useful as levee spillways. In some cases, these structures may be an alternative to gated spillways, which require operation and maintenance and can cause downstream flooding from misoperation or failure. Examples of 3D weirs include: arced or curved weirs, box-inlet drop spillways, labyrinth and piano-key weirs, and labyrinth fuse gates. Because of their hydraulic performance and site-adaptive geometries, these types of weirs are of increasing interest to those involved in dam safety, including practitioners, researchers, regulators, and dam owners. However, these spillways have complex hydraulic behaviors and can be challenging to develop efficient designs.

**Designing Spillways to Mitigate Failure Modes**

**INSTRUCTOR** John Trojanowski, Trojanowski Dam Engineering, Limited

**OBJECTIVE** This course will present potential failure modes for chute spillways and ways to design these spillways to minimize the potential for failure.

**Developing Operations and Maintenance Manuals for Dams**


**OBJECTIVE** This webinar will provide participants with information on the importance of preparing operations and maintenance (O&M) manuals for dams. It will include an overview of some of the key federal agency and state requirements and formats for dam O&M manuals. Operations and maintenance guidelines will be presented for both embankment and concrete dams and key dam appurtenances, such as spillways and outlet works. Many examples will be provided that illustrate the key elements of a comprehensive dam O&M manual including: O&M responsibilities, routine and periodic inspections, instrumentation and monitoring, dam operations, maintenance guidelines, interaction with emergency actions, and interaction with risk assessments.

**Drilling Plans and Hazard Evaluations for Dams and Levees**

**INSTRUCTOR** Doug Boyer, Federal Energy Regulatory Commission

**OBJECTIVE** Drilling into, in close proximity to, or through dams, levees, and their foundations may pose significant risk to the structures. Damage created by hydraulic fracturing and other means during the drilling process (use of inappropriate drilling methods), improper in-situ sampling techniques, and/or unacceptable methods of completing (backfilling) borings can open seepage paths that could create conditions conducive to internal erosion (piping) and ultimately dam failure. This webinar will provide an overview of existing guidance for drilling in and near embankment dams and their foundations. Of special emphasis will be the identification and assessment of drilling hazards for the prevention of damage to the embankment, structures, and their foundations from hydraulic fracturing, heave, erosion, filter/drain contamination, or other mechanisms during drilling-related activities. The webinar will also describe the typical requirements of a site drilling plan for any exploration drilling, instrument installation, or remediation drilling (including grouting) work to occur on an embankment dam, in proximity of the dam in which the drilling methods could pose a risk to the dam, or the dam’s foundation and abutments.

**Drone Technology Integrated into Dam Safety Inspections and Evaluations**

**INSTRUCTORS** Jay Halligan and Greg Daviero, Ph.D., P.E., Schnabel Engineering

**OBJECTIVE** During recent years the use of unmanned aerial vehicles (UAVs) or drone technology for the inspection and monitoring of dams and levees has increased. This rate of integration is, in part, due to FAA regulation revisions and the advantages regarding personnel safety, flexibility, speed and volume of data acquisition, and cost. This webinar presents an overview of drones and how this technology can be incorporated into dam safety inspections and evaluations. Although drones are a cost-effective and efficient contribution to inspections, there are regulatory requirements for use and challenges with data acquisition—things to know before you fly. These include various flight rules, authorizations, accuracy requirements, flight strategies and site conditions, shadowing, and handling and processing large amounts of geospatial data. This webinar presents insights into these
challenges and common pitfalls to encourage the appropriate use and application of this emerging technology. This webinar also highlights the advantages of drone technology, why it is well suited to dam and levee safety applications, and how it can complement and provide new approaches to observe and inspect dams and levees. Included is a selection of recent site inspections that incorporated drone technology to successfully gather information and allow an inspection team to more safely and efficiently observe areas that are not accessible or difficult to access.

**Earthquake Hazards, Ground Motions and Dynamic Response**

**INSTRUCTORS** Lelio H. Mejia, Ph.D., P.E., G.E., AECOM; and William A. Fraser, CA Division of Safety of Dams (Retired)

**OBJECTIVE** Earthquakes represent a hazard to dams in many parts of the United States and therefore are of interest to design engineers and dam safety officials. The hazard from earthquakes includes strong shaking, fault rupture displacements, reservoir seiche and earthquake-induced landslides, all potentially damaging to dams and reservoirs. This webinar will discuss the physics and geology of the earthquake process and the methods used to identify seismic hazards in the field such as identifying geologic indicators of past earthquakes. The factors that control the earthquake ground motion at a site and the approaches used to predict ground motions for engineering analysis will be discussed. The intensity measures most commonly used to describe ground motions will be discussed along with the use and modification of motions for engineering analyses of dams. Finally, methods used to predict the dynamic response of embankment dams and their soil foundations to earthquake motions will be presented.

**Emergency Action Plan Basics**

**INSTRUCTOR** John W. France, P.E., D.C.E., D.WRE, AECOM

**OBJECTIVE** This webinar is intended to introduce emergency action plans (EAPs) for dam safety emergency planners, dam owners, dam regulators, and consultants. The webinar will include information that will be useful to participants in developing new EAPs and improving the effectiveness of existing EAPs. The agenda is structured to answer the following key questions: Why are EAPs important? What are the important components of an effective EAP? How do EAPs relate to other aspects of emergency planning? How do you develop, update, and test an EAP?

**Empirical Estimates of Permeability for Earth Dam Projects**

**INSTRUCTOR** Danny K. McCook, P.E., McCook Geotechnical Engineering, PLLC

**OBJECTIVE** This webinar provides a thorough discussion of the range of permeability likely in natural and recompacted embankment soils. Empirical correlations and charts are provided that can assist in the evaluation of design report assumptions and models used for seepage analyses. Various empirical techniques such as the Kozeny-Carman equation, Chapuis’s equation, the Slichter method, and others will be discussed. Examples and illustrated problems will be provided. The importance of anisotropy will also be discussed.

**Evaluation and Maintenance of Piezometers, Relief Wells, and Drains in Dams and Levees**

**INSTRUCTORS** Charles N. Easton, P.E., and Russell Glenn Springer, P.E., Freese and Nichols, Inc.

**OBJECTIVE** Many dams and levees have embankment drains, structure underdrains, and relief wells to control seepage through and beneath the dam and piezometers to monitor the performance of these features. Dam and levee owners, managers, and maintenance staff may be uncertain about the function of these features and what maintenance is required. This webinar will summarize seepage principles and terminology in layman’s terms and describe the purposes and function of relief wells, drains, and piezometers. Examples will be shown of the types of deterioration and damage that can occur. Procedures for evaluating monitoring data and inspecting, testing, and repairing drainage features and piezometers will be presented. Experienced professional guidance is needed to avoid damage, but much of the work can be performed by the local maintenance personnel using common equipment and home-built tools.

**Evaluation of Seepage Related Potential Failure Modes (PFMA’s) in Embankments with Emphasis on Outlet Penetrations**

**INSTRUCTOR** Keith A. Ferguson, P.E., HDR Engineering, Inc.

**OBJECTIVE** Evaluation of potential seepage failure modes in embankment dams and in particular around outlet works penetrations is a very important aspect of dam safety evaluations. Assessing potential seepage failure modes typically requires designing and evaluating investigation and instrumentation programs, and a variety of engineering analyses. Experience has shown that adverse seepage and piping conditions can develop and remain difficult to detect until the potential failure mode is in an advanced stage of the continuation phase of the development process. In this webinar, a framework will be presented for identifying, investigating, analyzing, and evaluating potential failure modes around outlet penetrations. Case histories will be used to illustrate the challenges associated with these assessments. Results of engineering seepage and stress analyses will be presented to better understand potential failure mode development mechanisms including the potential for cracking and hydraulic fracturing.

**Event Tree Principles and Applications for Dam Safety Risk Assessment**

**INSTRUCTOR** David S. Bowles, Ph.D., P.E., P.H., D.WRE, FASCE, RAC Engineers and Economists, LLC

**OBJECTIVE** Event tree analysis is commonly used in dam safety risk analysis. Event trees are tools used to aid in understanding, analyzing, and communicating dam safety risks and for informing dam safety decisions. Like all other tools they are imperfect, and their potential value depends on the skills of their user. Event trees can be used to obtain quantitative estimates of the probability of dam failure and its associated consequences. This can be done for an existing dam or for structural or to compare non-structural risk reduction alternatives. Event trees can also serve as qualitative or diagrammatic representations of failure modes and their consequences. This webinar will summarize the principles of event trees and their application in dam safety risk assessment. It will include discussion of the construction of event trees, the calculations associated with event tree analysis and various type of post processing such as tolerable risk evaluation, which is important in support of dam safety decisions.

**Exploring Dam Breach Parameters: Observed and Modeled**

**INSTRUCTOR** Amanda J. Hess, P.E., CFM, Gannett Fleming, Inc.

**OBJECTIVE** Dam breach modeling is commonly used to classify the hazard potential of a dam, establish the inflow design flood and other design criteria of a dam, and plan for emergency response in the event of an incident or failure. Dam breach analyses are also an essential

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component of risk analyses. The results of a dam breach analysis can be very sensitive to the assumed dam breach parameters of breach size, shape, and timing.

In dam breach modeling, estimates of dam breach parameters are frequently based on observed dam failures, either based on direct comparison or based on empirical relationships derived from the population of dam failures. This webinar will review the methods available to estimate breach parameters and provide comparisons to historical dam breaches and research data. Uncertainty and sensitivity will be discussed.

**Extreme Precipitation and Dam Safety in a Changing Climate**

**INSTRUCTORS** Charles N. Thompson, P.E., New Mexico Office of the State Engineer; Mark Perry, P.E., State of Colorado; Jeff Lukas, Lukas Climate Research and Consulting, LLC; Kelly Mahoney, National Oceanic and Atmospheric Administration, Physical Sciences Laboratory

**OBJECTIVE** Essential to dam design and dam safety is the reliable assessment of hydrometeorological hazards such as extreme precipitation events and associated flooding. The traditional methods for assessing these hazards, such as estimation of Probable Maximum Precipitation, assume stationarity in risk over time and into the future. However, the climate at global, national, and local scales has become clearly non-stationary in recent decades, and there is increasing evidence that climate change is affecting key aspects of extreme events and storm environments. The best available science indicates that these changes and their overall impacts on extreme precipitation will become even larger over the next several decades.

In this webinar, we will first review the physical mechanisms that govern extreme precipitation events, the state of the science on the observed and expected changes in these mechanisms, and the overall effects on extreme precipitation events in the U.S. Then, we will describe how key federal agencies and others in the dam safety community have responded to these risks from a changing climate by reconsidering traditional practices, conducting pilot studies, and issuing new guidance. We will conclude by outlining potential pathways for dam safety programs and dam owners to incorporate climate-change risk into regulation and practice, highlighting recent experience in the states of Colorado and New Mexico.

**Field Investigations for New and Existing Dams**

**INSTRUCTOR** Ray E. Martin, Ph.D., P.E., D.GE., REM, LLC

**OBJECTIVE** The purpose of the webinar is to provide an overview of the process required to developing field investigation programs for design of new dams or rehabilitation of existing dams. The presentation will include the four phases that are typical of field investigations for new and existing dams. The presentation will highlight the important aspects of each phase from planning to execution, including defining their goals. Phases discussed include site reconnaissance, geologic study, preliminary field investigation, and final field investigation.

**Filter Design History and a One-Step Design Process**

**INSTRUCTORS** James R. Talbot, P.E., Consulting Engineer; and Danny K. McCook, P.E., McCook Geotechnical Engineering, PLLC

**OBJECTIVE** The webinar consists of two basic parts – a history of filter design practice (including theoretical design considerations) and a step-by-step design process with criteria for the design of a critical filter for one example soil type. The primary topics covered in the first part of the webinar include early filter designs that address only interparticle seepage and piping, the historical research performed by Sherard et al. to develop critical filters for soils with defects (cracks, etc.) in the soil, and the basis for regrading soils that contain considerable coarse-grained particles (gravel). The primary topics covered in the second part of the webinar include a simplified, step-by-step process for designing filters that will comply with most agency design criteria; and a step-by-step detailed example of a filter design for one of the four base soil categories. This step-by-step process is related to the most common agency design criteria and steps, including those of the USACE, Reclamation, and the NRCS.

**Filters and Drainage Systems for Embankments Dams**

**INSTRUCTORS** John W. France, P.E., D.GE, D.WRE, JWF Consulting LLC; and Jennifer L. Williams, P.E., AECOM

**OBJECTIVE** This webinar will review the design and construction of filters and drains for embankment dams. Specific topics covered will include principles of filters and drains, locations and configurations of filters and drains in embankment dams (for both new dams and dam rehabilitations), design guidelines for filters and drains, evaluations of filters and drains in existing embankment dams, and practical considerations for design and construction of filters and drains.

**Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan**

**INSTRUCTOR** John W. France, P.E., D.GE, D.WRE, JWF Consulting, LLC

**OBJECTIVE** This webinar will summarize the findings of the Independent Forensic Team (IFT) tasked with investigating the May 19, 2020 failures of the Edenville and Sanford Dams in Michigan. The chronology of events leading up to the dam failures will be detailed. The likely physical mechanisms for the failures will be described, along with the range of potential mechanisms considered by the IFT. Contributing factors to the failures, including human and organizational factors will be discussed. Emergency actions that included the evacuation of up to 10,000 people will also be discussed. Finally, lessons to be learned from the failures will be reviewed.

**Findings of the Oroville Dam Spillway Forensic Investigation**

**INSTRUCTOR** John W. France, P.E., D.GE, D.WRE, President, JWF Consulting, LLC

**OBJECTIVE** At a height of 770 feet, Oroville Dam is the tallest dam in the United States. On February 7, 2017, a section of the concrete chute slab of the service spillway at Oroville Dam failed during spillway discharge. Several days later, as the California Department of Water Resources was evaluating and managing discharges through the damaged service spillway during a large rainfall event, the emergency spillway activated for the first time in the project’s history. The emergency spillway flow resulted in significant erosion of the hillside below the crest structure, leading to concern for the integrity of the emergency spillway and the evacuation of nearly 190,000 downstream residents. The Federal Energy Regulatory Commission mandated a forensic evaluation of the failure of the service spillway chute and the damage to emergency spillway. This webinar will present the findings of the six-person Independent Forensic Team, including discussions of physical factors, human/organization factors, and lessons to be learned from the incident.

**Foundation Cutoff Walls for Dams and Levees**

**INSTRUCTOR** Dr. Donald A. Bruce, Geosystems, L.P.

**OBJECTIVE** During the last 10 years, there have been unparalleled levels of activity in dam and levee foundation remediation. This has
been triggered mainly by the U.S. Army Corps of Engineers’ evaluation of their dam and levee portfolio following the disastrous flooding of New Orleans and surrounding areas in 2005. Remedial diaphragm walls have been installed in dams in the US since 1975 when Wolf Creek Dam, in Kentucky, was repaired for the first time. Since then, there are approximately 30 case histories that can be reviewed, up to the present day. This webinar reviews the different methods used to create foundation cutoff walls by methods other than grouting alone. A distinction is drawn between Category 1 walls (which are "excavate and replace") and Category 2 walls (which are "mixed in place").

**Foundation Preparation and Treatment for Dam Construction**

**INSTRUCTOR** John W. France, P.E., D.GE, D.WRE, JWF Consulting, LLC

**OBJECTIVE** This webinar will address a wide range of foundation preparation and treatment methods applicable to construction of new dams, rehabilitation of existing dams, and enlargement of existing dams. Topics to be covered include: treatment of surface rock exposures in dam foundations, rock grouting, treatment of foundation soils, foundation seepage barrier walls and upstream blankets, and foundation seepage collection and control methods.

**Fundamentals of Concrete Construction**

**Inspections for Dams and Appurtenant Structures**

**INSTRUCTORS** Mike Zusi and Henrik Forsling, AECOM

**OBJECTIVE** This webinar will review field inspection of concrete structures for dams, water conveyances, and levees. Specific topics to be covered will include foundation preparation, reinforcing steel inspection, embedded items, formwork, concrete joints, waterstop installation, and concrete mixes and placement.

**Guidelines for Assigning Erodibility Parameters to Soil Horizons for SITES Analyses**

**INSTRUCTOR** Danny K. McCook, P.E., McCook Geotechnical Engineering, PLLC

**OBJECTIVE** The SITES computer program provides engineers with a tool for predicting the formation and progress of a headcut in an auxiliary spillway during a design storm. The predicted performance given by SITES includes the extent and speed of development of a headcut that may develop in the auxiliary spillway. The predicted erosion in the spillway depends on (1) the duration and quantity of design flow through the spillway during the design storm (design hydrograph), and (2) the erodibility parameters of the soil and bedrock horizons in the spillway model. The erodibility factors used in SITES are the headcut erodibility index Kh and the detachment rate coefficient, kd. This webinar provides guidance primarily on selection of Kh and kd parameters for soils. Soils are vastly more erodible than bedrock and the erosion potential of soil horizons is extremely important in the predicted performance of any spillway that is not situated solely on bedrock. The webinar does not provide specific training on the actual use of the computer program SITES. The training in the webinar is confined to guidance related to the selection of the two erodibility factors for soil. Bedrock is not explicitly included in the webinar training, but some of the same principles in selecting the Kh and kd parameters for soils also apply to bedrock materials. Information is extracted from NRCS publications on the SITES program as well as supplemental guidance developed by the webinar trainer, Mr. McCook.

**HEC-RAS 2D Modeling**

**INSTRUCTORS** Arthur C. Miller, Ph.D., D.WRE, AECOM; and Amanda J. Hess, P.E., CFM, Gannett Fleming, Inc.

**OBJECTIVE** With the release of HEC-RAS 5.0 (and newer versions), the Hydrologic Engineering Center (HEC) added the ability to perform two-dimensional (2D) hydrodynamic routing to the HEC-RAS computer model. This webinar will provide an overview of the new HEC-RAS 2D tools and solution processes and the basic capabilities of the HEC-RAS 2D model. The 2D flow modeling can be accomplished by adding 2D flow area element. This is similar to adding a storage area in a 1D unsteady flow model. The flow area is developed by adding a 2D polygon, developing the computational mesh, and linking the 2D flow area either to a 1D model element or directly connecting boundary conditions to the 2D flow area. Each of these steps will be discussed. Guidelines on when to use 2D flow modeling and an example problem of developing a simple computational mesh and running the model will also be covered.

**How to Communicate Effectively in Any Situation**

**INSTRUCTOR** Leonard S. Greenberger, Potomac Communications Group, Inc.

**OBJECTIVE** ASDSO members are called upon to communicate in many different situations — in presentations to colleagues, testimony before regulatory bodies and legislative committees, and interviews with reporters. Whatever the circumstances, best practices can help to ensure that communication is as effective as possible. Specific learning objectives include gaining a better understanding of effective media communications and presentation skills, best practices in the art of communication, and skills and techniques that can raise trust and credibility in order to communicate more effectively in tough situations.

**How to Conduct a Successful PFMA – Lessons Learned from Past Successes and Failures**

**INSTRUCTOR** Douglas D. Boyer, P.E., CEG, Federal Energy Regulatory Commission

**OBJECTIVE** Potential failure modes analysis (PFMA) was first used in dam safety over twenty years ago. Although thousands of PFMA workshops have been conducted since it was first introduced, the use and application of PFMAs is still mostly limited to larger federal agencies and occasionally by others on larger projects. PFMA is a tool and a framework to evaluate dam and levee safety. It has fundamentally changed the way many now approach assessing and solving dam and levee safety issues. It’s the first question asked by decision makers prior to deciding if actions or expenditures are warranted — “So what’s the potential failure mode?” The PFMA process has evolved over the years with new twists, ideas, and improvements to the process. Still, improvements are needed, some of which have been pointed out in the Groville Spillway Independent Forensic Team Report. Preparation, process, and team composition remain key factors in the success or failure of a PFMA. This webinar will provide examples (both good and bad) and some suggested guidance.

**How to Make Your Emergency Action Plan More Effective**


**OBJECTIVE** In the last forty years, dam safety professionals have recognized the importance of preparing emergency actions plans (EAPs) as an effective tool to minimize the consequences of dam failures. In the last 15 years, the National Incident Management System (NIMS) was established, and the Incident Command System (ICS) has become a more important emergency response tool. As a result, EAP formats, procedures for testing dam EAPs, and training personnel have evolved to meet the needs and capabilities of the emergency.
management and emergency response community. In recent years, we have learned some valuable lessons about the effectiveness of EAPs as part of an efficient emergency response from recent large storm events in the United States. This webinar will provide a brief overview of the evolution of emergency response and EAPs for dams and discuss key elements and formats for dam EAPs as well as some thoughts on the future of more effective and simplified EAP formats. We will provide some tools to improve decision making, preventative actions, and communications during dam incidents and emergencies. We will also provide an overview of some of the latest inundation mapping tools and techniques. The differences between EAPs for dams and levees will also be highlighted. The webinar will conclude with an EAP effectiveness checklist that will highlight dam owner, consultant, state dam safety program, and emergency management and response perspectives.

Human Factors in Dam Failure and Safety
INSTRUCTOR Irfan Alvi, P.E., Alvi Associates, Inc.

OBJECTIVE Dam failures typically result from interactions of human and physical factors which extend over years or decades. Understandably, engineers and others involved with dams normally focus on the physical factors. However, because physical systems such as dams are subject to physical laws and do not make ‘mistakes,’ it may be asserted that dam failures (and incidents) are fundamentally due to human factors. The other side of this coin is that dam safety must then also be fundamentally due to human factors. Human factors which are primary drivers of failure include (a) tradeoffs associated with non-safety goals (e.g., reducing costs, meeting tight schedules, and political pressures), (b) inherent human fallibility and limitations (e.g., incomplete information, inaccurate models, and cognitive biases), and (c) cognitive effects of having to deal with complexity (e.g., counterintuitive system behavior). These drivers of failure in turn result in various types of human errors (e.g., mistakes, slips, and lapses) and inadequate risk management (e.g., risk ignorance, complacency, or overconfidence). Conversely, human factors which contribute to safety include (a) organizational ‘safety culture,’ with a corresponding humble and vigilant attitude with regard to preventing failure, and (b) numerous best practices related to general design features of dams, organizational and professional practices, and addressing warning signs. From the perspective of this framework, failures generally result when the human factors contributing to safety are not sufficient to outweigh those contributing to failure (i.e., demand exceeds capacity). This webinar will provide a framework for engineers, contractors, owners, regulators, inspectors, maintenance staff, and others involved with dams to systematically think about the human factors which contribute to dam failure and safety, and will include detailed discussion of several of these factors. Use of the framework will also be illustrated by its application to case studies of dam failures, as well as a case study where failure was prevented by vigilant implementation of best practices.

Human Factors in the Edenville Dam Failure
INSTRUCTOR Irfan Alvi, P.E., Alvi Associates, Inc.

OBJECTIVE On May 19, 2020, Edenville Dam, located in central Michigan, suddenly failed when its lake reached a historically high level, despite the dam not overtopping. When Edenville Dam failed, the resulting breach flow resulted in overtopping failure of the downstream Sanford Dam, and necessitated evacuation of about 11,000 people. While the resulting property damage was estimated to be more than $200 million, the evacuation was successful in preventing serious injuries and loss of life. This webinar will serve as a “Part 2” continuation of a prior ASDSO webinar, “Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan,” which presented an overview of the findings by the five-person Independent Forensic Team. This webinar will expand on the discussion of human factors contributing to these dam failures, beginning with the design and construction of the projects, and continuing through the decision-making during the emergency response.

Human Factors in the Oroville Dam Spillway Incident
INSTRUCTOR Irfan Alvi, P.E., Alvi Associates, Inc.

OBJECTIVE On May 19, 2020, Edenville Dam, located in central Michigan, suddenly failed when its lake reached a historically high level, despite the dam not overtopping. When Edenville Dam failed, the resulting breach flow resulted in overtopping failure of the downstream Sanford Dam, and necessitated evacuation of about 11,000 people. While the resulting property damage was estimated to be more than $200 million, the evacuation was successful in preventing serious injuries and loss of life. This webinar will serve as a “Part 2” continuation of a prior ASDSO webinar, “Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan,” which presented an overview of the findings by the five-person Independent Forensic Team. This webinar will expand on the discussion of human factors contributing to these dam failures, beginning with the design and construction of the projects, and continuing through the decision-making during the emergency response.

Hydraulic Design of Labyrinth Weirs
INSTRUCTORS Blake Tullis, Utah State University; and Brian Crookston, Ph.D., P.E., Schnabel Engineering

OBJECTIVE Labyrinth weirs are widely used in spillway rehabilitation to upgrade existing dams to meet updated spillway design flood criteria. In addition to increasing discharge capacity, these weirs are also well suited to regulating upstream pool elevations for flood control or at intake structures. The hydraulic design of a labyrinth spillway requires the consideration of complex flow characteristics and optimization of multiple geometric parameters in an iterative process. In addition to maximizing hydraulic performance, other considerations must be considered (e.g., site characteristics, construction costs, and operational objectives and requirements) when designing a labyrinth weir control structure. During the past 10 years, considerable research has been performed at Utah State University on the hydraulics of labyrinth weirs. This webinar presents the application of the resulting design methodology, information, and guidance used to develop effective labyrinth spillway designs. Technical components include the influence of labyrinth weir geometry (sidewall angle and crest shape) on discharge efficiency, in-channel and reservoir-specific labyrinth weir applications, nappe interference, nappe behaviors, tailwater submergence effects, staged labyrinth weir hydraulics, high headwater ratios, downstream residual energy, generalized spillway construction costs, and a comparison between labyrinth spillways and a similar spillway type, the piano key weir.

Hydraulics 101: Intro to Hydraulics for Dam Safety
INSTRUCTOR Arthur C. Miller, Ph.D., D.WRE, AECOM

OBJECTIVE This webinar stresses the fundamentals of hydraulics and its application to dam safety. The presentation will include four short sessions: (1) Fluid Flow, (2) Uniform Flow in Open Channels, (3) Specific Energy, and (4) Water Surface Profile. Precedes the webinar Hydraulics 201.

Hydraulics 201 for Dam Safety
INSTRUCTOR Arthur C. Miller, Ph.D., D.WRE, AECOM

OBJECTIVE This webinar will have four one-half hour sessions and will begin with a brief review of the Hydraulics 101 lectures. Uniform flow,
specific energy, and gradually varied flow will be covered in the first session. Hydraulic modeling and water surface profile computations will be covered in the second session, and geometric data requirements will be addressed in the third session. The final session will concentrate on the development of the Hydrologic Engineering Center’s River Analysis System computer model (HEC-RAS).

**Hydrologic Hazards – Estimating Probabilities of Extreme Floods**

**INSTRUCTOR**  Dr. John F. England, Jr., U.S. Army Corps of Engineers

**OBJECTIVE**  Hydrologic hazard curves are critical flood loading inputs for dam and levee safety risk assessments. Over the past decade, some federal agencies have developed and applied new tools and data sets to estimate hydrologic hazard curves, which are graphs of peak flows, volume, or reservoir stages versus Annual Exceedance Probability (AEP). Hydrologic hazard curves provide a full probability distribution for the flood hazard, covering the range of extreme flood probabilities with uncertainty with AEPs typically to 1/100,000, and relevant for assessing hydrologic failure modes. Streamflow-based statistical methods and Monte-Carlo rainfall-runoff methods are the main approaches used to estimate hydrologic hazards. This webinar provides an overview and background on current data and methods used in estimating hydrologic hazard curves for dam and levee safety. Participants will gain an understanding of: hydrologic hazard curves for dam and levee safety risk analysis, extreme storm, flood, and paleoflood data sets for hydrologic hazard curves; hydrologic hazard methods currently in use by USACE and other federal agencies for dam safety risk analysis; the philosophy and approach used to integrate meteorology, flood hydrology and paleoflood hydrology to estimate hydrologic hazard curves with uncertainty; and ongoing activities and future directions in estimating hydrologic hazard curves.

**Hydrology 101 for Dam Safety**

**INSTRUCTOR**  Arthur C. Miller, Ph.D., D.WRE, AECOM

**OBJECTIVE**  The webinar stresses the fundamentals of hydrology and is an introduction to the Hydrologic Processes. The class will stress the importance the fundamentals and its application to dam safety. Precedes the course Hydrology 201.

**Hydrology 201 for Dam Safety**

**INSTRUCTOR**  Arthur C. Miller, Ph.D., D.WRE, AECOM

**OBJECTIVE**  The Hydrology 201 webinar consists of four one-half hour segments. The first segment is a brief review of Hydrology 101 emphasizing some of the important hydrologic issues. The second segment will concentrate on the NRCS procedures to determine the loss rate function and the dimensionless unit hydrograph as it is utilized to transform excess rainfall into runoff. Different methods of determining time of concentration and lag time will be covered in this session. The third segment will be a brief introduction to the US Army Corps of Engineers Hydrologic Center’s computer model HEC-HMS, and the last segment will be an application of the NRCS procedures to a small watershed utilizing the HEC-HMS model.

**Identifying Hazards and Improving Public Safety at Low Head Dams**

**INSTRUCTORS**  Paul G. Schweiger, P.E., Gannett Fleming, Inc.; and Dr. Bruce A. Tschantz, P.E., University of Tennessee

**OBJECTIVE**  This webinar will provide participants with an understanding of the hidden dangers at low head dams and effective strategies for improving public safety. The instructors will illustrate their presentation with several examples drawn from their own experiences as hydraulic/civil engineers, expert witnesses, authors and engineering designers. Lessons learned from experience with litigation related to drownings at low head dams will be presented. Both non-structural and structural dam modifications to improve public safety will be discussed. Structural dam modifications will emphasize design concepts for modifying low head dams to eliminate the hazardous submerged hydraulic jump, which is the deadliest hazard.

**Improving the Dam Safety Design Review Process**

**INSTRUCTORS**  Jeremy Franz, CO Division of Water Resources; Michele Lemieux, MT Department of Natural Resources and Conservation; and Greg Paxson, Schnabel Engineering LLC

**OBJECTIVE**  This webinar will include a discussion of common challenges with the design review process for dam safety projects and present strategies to improve the efficiency and effectiveness of the process, with a focus on early and regular engagement of the owner, regulator, and designer.

**Inlet and Outlet Hydraulics for Spillways and Outlet Structures**

**INSTRUCTOR**  Arthur C. Miller, Ph.D., P.E., AECOM

**OBJECTIVE**  This webinar will begin with an overview of hydraulic grade lines and head losses associated with outlet structures and spillways for dams. The hydraulic structure must be designed to carry the planned flow for the expected head and tailwater conditions. Selection of the most appropriate hydraulic outlet structure depends upon the design discharge and the controlled head where the controlled head is the change in water surface elevation that will occur as discharge passes through the structure. It is important that the inlet be sized adequately to supply water to the spillway. The outlet conditions also affect the head-discharge relationship. The outlet must be sized properly so that the tailwater is deep enough to assist in energy dissipation, but not be located so that a tailwater floods out the structure (submerged tailwater condition). The concept of hydraulic control factors that can impact the location of the control will be covered in detail. This will include approach losses, entrance losses due to geometry, trash racks, and obstructions that impact inlet control computations. A few examples will be covered so that the participants will understand the concepts of inlet and outlet control.

**Inspection and Assessment of Spillways**

**INSTRUCTOR**  Paul G. Schweiger, P.E., Gannett Fleming, Inc.

**OBJECTIVE**  The February 2017 incident involving both the principal and auxiliary spillways of Oroville Dam in California brought considerable attention to potential failure modes associated with both structural and unlined spillways. Based on the lessons learned from this event and the subsequent findings of forensic investigations, many dam owners initiated their own spillway assessments. The goal of this webinar is to provide information to help engineers inspect and assess spillways. It will explain the different types of spillways, discuss their performance requirements, and provide a general historical evolution of typical spillway construction features with an emphasis on common vulnerabilities of older spillways and best practices and defensive measures for modern spillways. Deficiencies and weaknesses in historic spillway designs and how the integrity of spillways can change over time will be highlighted. Checklists to help practitioners identify potential physical factors that can contribute to the failure of structural and unlined spillways will be presented. Recommendations and warning signs for inspectors are discussed.
Internal Erosion – Applying Erosion Mechanics From ICOLD Bulletin 164 In Internal Erosion Failure Mode Analyses

INSTRUCTORS John W. France, P.E., D.GE, D.WRE, JWF Consulting, LLC; and Rodney Bridle, Dam Safety Ltd.

OBJECTIVE Internal erosion causes about half of all failures of water-retaining earth embankment dams. Similar statistics apply to levees. Internal erosion occurs when the hydraulic loads imposed by water seeping through the pores or flowing through cracks and openings in the soils in embankments and their foundations generate erosive forces sufficient to overcome the resistance to erosion of those soils. The knowledge of internal erosion processes has advanced significantly over the past two decades. The two volumes of ICOLD Bulletin 164 (ICOLD 2017, ICOLD, 2016) reflect the results of a group of international experts to collect information from experience, case histories, and research to provide guidance on internal erosion for engineers in dams and levees. The accumulation of knowledge led to the definition and understanding of the mechanics of the four modes of internal erosion. This understanding of internal erosion mechanics makes it possible for engineers to estimate the hydraulic load that will likely cause internal erosion to failure. The mechanics of the modes of internal erosion (mechanisms) can be combined with the internal erosion pathways through embankments and their foundations to developed detailed descriptions of potential failure modes (PFMs). If desired, these detailed PFM descriptions can be used in quantitative risk analyses. This webinar will include discussion of all the concepts described above, with reference to how the bulletin provides a reference to the application of these concepts in dam safety evaluations and risk analyses.

Intro to Cavitation in Chutes and Spillways


OBJECTIVE The course is intended to give the participants an understanding of cavitation on chutes and spillways. The course will be introduced with a video of a case study that illustrates some of the fundamentals of cavitation and an explanation of why cavitation causes damage. Following the video, a PowerPoint presentation will discuss the beneficial effects of aeration on preventing damage due to cavitation. The participants will be guided to an Excel program that reproduces all the Fortran programs given in EM 42. The spreadsheet can be used to analyze chutes and spillways for their hydraulic and cavitation performance, design aerators, determine the best vertical alignment to minimize cavitation inception, and analyze the cavitation damage potential of historic data.

Intro to Post-Tensioned Anchors for Dams

INSTRUCTOR Dr. Donald A. Bruce, Geosystems, L.P.

OBJECTIVE The course will describe the evolution of prestressed rock anchor technology as applied for over 50 years to dams in North America. This evolution will be presented through an analysis of the successive phases of the PTI “Recommendations” documents, which constitute the referenceable standard of care. Special attention will be paid to issues associated with long-term performance and the so called “Legacy Anchors.”

Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?

INSTRUCTORS Richard R. Davidson, P.E., and Christina J. Winckler, P.E., AECOM

OBJECTIVE A large difference between water storage dams versus tailings dams and coal ash impoundments is that these industrial structures are always under construction. This provides the opportunity to optimize design and construction but places an emphasis on ongoing evaluation and monitoring. This course provides an overview of the unique construction and design components of these facilities. This course will examine several recent failures that have plagued the industry but provide valuable lessons for the future.

Introduction to Addressing Inadequate Conveyance Capacity at Dams

INSTRUCTOR Paul G. Schweiger, P.E., Cannett Fleming, Inc.

OBJECTIVE The most common deficiency at dams in North America is inadequate spillway capacity. Inadequate spillway capacity can result in overtopping of a dam during flood events. This is especially a concern for embankment dams where overtopping of the dam embankment can cause breaching of the dam and uncontrolled release of the impounded water. This failure mode accounts for more than 40 percent of recent dam failures. A broad overview of the many approaches, including state-of-the-art technologies, to effectively modify existing dams to meet current spillway capacity requirements will be presented. The various approaches will be illustrated with photographs from recently modified dams and case studies.
Introduction to Concrete Gravity Dams

INSTRUCTOR Robert A. Kline, Jr., P.E., Gannett Fleming, Inc.

OBJECTIVE With the development in Europe in the later 1800s of a rational method for evaluating structural stability combined with practical experience, U.S. engineers gained greater confidence in increasing the structural height and loadings on masonry dams, as they were known then. This led to record setting heights in the U.S. for several gravity dams built for water supply purposes for major U.S. cities. As records were being set, a few dramatic concrete gravity dam failures occurred which sparked wide debate concerning whether rational methods adequately accounted for various destabilizing external forces acting on a gravity dam. Many practicing engineers agreed that although estimates and likely ranges can be assigned to these forces, for some, exact values are indeterminate. Recognition was also given to the variable nature of material strength properties. This led to the adoption of the use of safety factors to better account for the indeterminate and variable nature of such factors. Since many U.S. gravity dams in service today were constructed decades ago while design practices were still evolving, historical background and for design and construction practices will be presented to provide today’s practitioners with a better understanding of potential vulnerabilities in these structures. Select noteworthy gravity dam failures will be presented as well with an emphasis on lessons learned from these failures.
including common variations in grouting techniques, grout mixes, and recent advancements in grouting technology. The information presented will be illustrated using case studies of grouting for new dams and for dam remediation projects. There are no specific education or experience prerequisites for this webinar, although some knowledge/experience of dam design would be beneficial.

Introduction to Hydrologic Modeling Using Geospatial Information


OBJECTIVE  The field of hydrology experienced its most dramatic period of development from the late 19th century to the mid-20th century. While the theory and equations used to estimate watershed runoff have remained relatively unchanged since that time, the availability of Geographic Information Systems (GIS) software and geospatial data has modernized the methods used to evaluate watershed characteristics and develop input parameters. Today’s hydrologic engineer should understand the advantages and disadvantages of using geospatial data to support hydrologic analysis, recognize the type of spatial data that is available and needed for such analysis, and be aware of the steps required for building a hydrologic model based on geospatial data.

Introduction to Nature-Like Fishways for Dams

INSTRUCTOR  Dr. Luther Aadland, MN Department of Natural Resources

OBJECTIVE  Dam-related problems include blockage of fish migrations, drowning hazards, failure hazards, reservoir sedimentation, habitat loss, and tailwater erosion. Some environmental problems can only be addressed through dam removal while other issues, where removal is not a viable option, can be remediated by dam modification and nature-like fish passage. Traditional fish passage projects have typically focused solely on passage of single or few large game species. As the name implies, nature-like fishways emulate natural river geometry. Nature-like fish passage includes full width dam modifications that have been applied to address dam and levee stability issues, eliminate dangerous hydraulic undertows, provide spawning habitat, provide recreational boating, grade control or sediment stabilization in dam removal and river restoration, and pass the full spectrum of native fish species. These broad benefits have drawn a diversity of funding from federal, state, and local sources. This course will introduce nature-like fishway types, design principles, applications, case examples, and associated benefits.

Introduction to Physical Modeling of Spillways for Dams

INSTRUCTOR  Steven L. Barfuss, P.E., Utah State University Research Foundation

OBJECTIVE  Physical models have been used as part of the design process for spillways and other hydraulic structures for centuries. Their use has proven to be extremely effective for validating hydraulic design schemes for new and rehabilitated spillways, for the discovery of hydraulic design problems that previously had not been expected, and in reducing construction costs. Physical modeling is also important for public relations, for reducing risk, and improving public safety. In recent years, the integrated use of physical modeling performed in conjunction with numerical modeling has become commonplace (aka composite modeling). Webinar examples will illustrate hydraulic problems that were successfully solved using a physical model that may have been missed if a physical model was not utilized. This webinar will cover the "how" and "why" of physical modeling, model similitude, physical modeling measurements, model validation, the downside to physical modeling, and specific benefits of physical modeling.

Introduction to Public Safety Risk Evaluation and Treatment for Dams and Levees

INSTRUCTOR  John D. Cattanach, P.Eng., Civil Engineer, (Retired)

OBJECTIVE  This webinar is designed to provide dam and levee owners, and their specialist consultants, an introduction to a comprehensive program to assess and reduce public safety risk around dams, levees, and powerhouses. In 2011 the Canadian Dam Association, an association similar in nature to the ASDSO, published Guidelines for Public Safety Around Dams. Dam owners across Canada are embracing these guidelines and are assessing and reducing public safety risk in a comprehensive and consistent manner. More people die in accidents around dam sites than from structural failures of these dams. In this webinar the participants will be shown examples of the hazards posed to the public by the presence and operations of dams and levees and will be reminded of the owner’s responsibility for managing these public safety risks. The participants will be made aware of a comprehensive methodology to identify and classify these risks, including the steps necessary to reduce them. Examples will be provided of where public safety (and security) risks can be reduced to acceptable levels through a series of control measures.

Introduction to Spillway Gates

INSTRUCTORS  Matt Moses, P.E., and Janis Murphy, P.E., Freese and Nichols, Inc.

OBJECTIVE  This course will introduce spillway gates, including an overview of different types of spillway gates. The key components of a gate condition assessment will be discussed. This course will cover how gate modeling has changed over time and the major items that have influenced the current design code. Typical gate repairs and issues, both normal and unique, identified with the inspection of spillway gates will be covered. Finally, removing gates from service and/or alternatives will be touched upon.

Judgment and Decision-Making in Dam Engineering

INSTRUCTOR  Irfan A. Alvi, P.E., Alvi Associates, Inc.

OBJECTIVE  Dam engineering is about dams but is done by and for people. As a result, in order to achieve dam safety, we need to understand not just dams, but also the people involved in designing, constructing, operating, maintaining, and benefitting from them. Social scientists have been studying people scientifically for more than a century, and we are now at a point historically where the social sciences have generated valuable insights into human thought and behavior. The aim of this webinar is to describe key socio-psychological insights and apply them to the practice of dam engineering, with an emphasis on judgment and decision-making. We will find that judgment and decision-making are influenced by aspects such as subconscious and conscious cognition, perception, attention, memory, modes of reasoning, self-concept, use of heuristics, cognitive biases, emotions, group influences and interactions, and culture, all of which contribute to both human capability and human fallibility. This webinar will use examples from dam engineering practice and conclude with evidence-based suggestions for how we can improve our judgment and decision-making at both individual and group levels.

Latest Trends in Roller-Compacted Concrete (RCC) Spillways and Overtopping Protection

INSTRUCTORS  Joshua Gilman, P.E., Portland Cement Association and Randall Bass, P.E., Schnabel Engineering, LLC
OBJECTIVE  This course will provide the latest details in design trends, mix designs, control sections, and construction means and methods for roller-compacted concrete (RCC) spillways and overtopping protection. With projects now over 40 years in service, it is clear which design criteria should be used to construct RCC hydraulic structures with long-term durability in extreme weather environments. This course will present what has been learned, along with today’s design trends, and will also look at other applications of RCC for hydraulic structures including support of CVC spillways and channel protection.

Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts

INSTRUCTORS  Mark E. Baker, P.E., National Park Service; and Bill McCormick, P.E., Colorado Dam Safety Branch

OBJECTIVE  Lawn Lake Dam, located in Rocky Mountain National Park, failed suddenly and catastrophically on a sunny day in July 1982, and resulted in over $30 million dollars in damage and the loss of 3 lives. This webinar will explore the history of the dam, construction features responsible for the failure, the failure event and emergency response, the long legal process to assign liability for the failure, and the overall impacts to the Town of Estes Park and its citizens, the Colorado Dam Safety Branch, and the National Park Service.

Legal Responsibilities of Dam Owners, Operators, and Regulators

INSTRUCTOR  Denis Binder, Chapman University

OBJECTIVE  This webinar will address the legal responsibilities in: owning and operating a dam under normal conditions, during a flood, or in cases of a breach; devising, testing, and updating emergency action and business continuity plans; and maintaining the dam to minimize the chances of failure and tragedy. Compliance with statutory and administrative minimums may not be sufficient to forestall liability. Liability can be especially perilous to private inspectors if the dam fails.

Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories

INSTRUCTORS  Raymond Seed, P.E., Ph.D., University of California, Berkeley; and Khaled Chowdhury, U.S. Army Corps of Engineers and University of California Berkeley

OBJECTIVE  Analyses of expected seismic performance of earthen dams subject to potential liquefaction hazard are routinely performed for high hazard dams. The State of Practice has increasingly evolved from simplified methods to the use of fully coupled seismic pore pressure generation and nonlinear seismic deformation analyses (NDA) using either finite difference or finite element analysis frameworks. To evaluate the accuracy and reliability of these NDA methods, the Upper and Lower San Fernando Dams field performance case histories from the 1971 San Fernando earthquake were re-analyzed in these current studies by means of fully nonlinear seismic deformation analyses, using (1) a suite of four analytical models, (2) a suite of three cyclic pore pressure generation relationships, and (3) a suite of three post-liquefaction residual strength relationships. The results of these analyses have shown that a successful implementation of non-linear deformation analyses would involve (1) how cyclic pore pressure generation and liquefaction triggering is accounted for in different constitutive modeling approaches, (2) treatment of critical state and dilatant behaviors in soils during shaking, (3) evaluation and implementation of post-liquefaction residual strength (SDL), (4) modeling of potential strain softening of the non-liquefiable (e.g. clays) soil layers, (5) continuation of the analyses through post-shaking conditions, (6) dealing with numerical difficulties associated with very large embankment displacements within the continuum analysis framework, and (7) suitable engineering assessment and interpretation of the analytical results. Failure to suitably accomplish any of these can result in potentially misleading and/or potentially unconservative findings. When these are suitably accomplished, seismic deformation analyses were found to be capable of producing excellent engineering insights and a good basis for engineering decision-making and/or mitigation design.

Loss of Life Consequence Assessment for Dam Failure Scenarios

INSTRUCTOR  Wayne J. Graham, P.E., Civil Engineer

OBJECTIVE  This webinar looks at the evaluation of loss of life resulting from a dam failure, use of loss of life estimates, hazard classification, improvement of emergency action planning, determination of individual and societal risk, a comparison of loss of life from dam failure to loss of life from natural hazards, the history of dam failure loss of life estimation with a focus on Bureau of Reclamation involvement, and learning from the past – factors that influenced loss of life during significant U.S. dam failures.

Low-Level Conduits – What Can Go Wrong, How to Inspect, How to Repair?

INSTRUCTOR  Joseph S. Monroe, P.E., Schnabel Engineering, LLC

OBJECTIVE  This course will provide an overview of commonly observed issues associated with the most common type of spillway for relatively small dams (riser and low-level conduit). Importantly, the presentation will summarize methods to evaluate the condition of existing conduits and present common methods to repair and/or replace conduits. At the completion of the course, the participants should be able to identify common issues with low-level conduits, to include inlets and outlets, and have probable courses of action to address the identified issues.

Managing Increased Dam Safety Risk During Reconstruction

INSTRUCTORS  Jennifer L. Williams, P.E., AECOM; and Del Shannon, P.E., Barnard Construction Company, Inc.

OBJECTIVE  Dams are inherently vulnerable during rehabilitation construction due to risks such as a weakened/reduced cross section of the structure or reduced flood passage capacity. Successful management of the risks salient to dam construction requires proactive identification, planning, and mitigation by all parties. This 2-hour webinar will examine typical risk categorization with a focus on dam safety during construction, the risk identification and evaluation process, and risk management strategies. These include design and construction mitigation measures, risk allocation and transfer, appropriate levels of investigation and monitoring, and emergency response planning. The discussion will draw from case histories and lessons learned considering perspectives from the design engineer, contractor, owner, and regulator.

Michigan Failures/Pandemic – Impacts to the ASDSO Peer Review Process

INSTRUCTORS  William B. Bingham; Robert H. Dalton, P.E., Veenstra & Kimm, Inc.; Dr. Dennis B. Dickey; Kenneth E. Smith, IN Department of Natural Resources; Luke Trumble, MI Department of Environment
OBJECTIVE: On May 19, 2020, failures of the Edenville and Sanford Dams in Michigan left a lasting impact, not only on the city of Midland, MI, and other localities, but also on the dam safety community writ large. Shortly after the failures, an ASDSO Peer Review was requested and conducted. This webinar will discuss various aspects of the peer review process—what is reviewed, why those items are reviewed, how that information is used in the preparation of the initial presentation to the agency, and the preparation of the written report. Lessons learned from the Michigan review will be highlighted. Since the report was submitted, the state of Michigan took many actions based on the recommendations in the report. These actions will be discussed, and the state agency will comment on the overall experience of the review process and the interaction with the review team.

Natural Resources Conservation Service Dam Design and Dam Safety Resources: Policy, Procedures, and Tools

INSTRUCTOR Steve Durgin, P.E., USDA-NRCS

OBJECTIVE This webinar will provide an overview of multiple dam design and dam safety resources available from the Natural Resources Conservation Service (NRCS). The overview will include a presentation on the NRCS history of building dams and dam safety. The policy presentation will focus on key dam design and dam safety elements in the NRCS General Manual, the National Engineering Manual, and NRCS directives process. The presentation on NRCS design and dam safety procedures will highlight various NRCS Conservation Practice Standards, NRCS National Engineering Handbook chapters, and several NRCS Technical Releases. The presentation on tools will include overviews and applications of NRCS computer software such as TR20, TR20, SITES, WinDAM, and DamWatch.

Pitfalls in Quality Control Processes for Compacted Earth Fill

INSTRUCTOR Danny K. McCook, P.E., McCook Geotechnical Engineering, PLLC

OBJECTIVE Quality control activities are important during the construction of an earth dam. The quality control program is intended to ensure that the compacted fill meets or exceeds all the specifications for the earth fill in the construction contract. The two primary specifications involve the degree of compaction and the acceptable range of water content for each zone in the compacted fill. This webinar provides guidance on common pitfalls in the quality control process. The most common pitfalls covered in the webinar are: 1. Failure to obtain and employ a correction factor that considers the difference between the water content measured with the nuclear density gage and the correct oven dry water content, 2. Failure to correctly determine a reference density test to which the field density test can be compared to obtain the correct degree of compaction for a test, and 3. Failure to consider correctly the presence of oversized rock or gravel particles at a test site. The common pitfalls are related to the ASTM specifications where applicable. While designed for quality control involved in the construction of earth dams, the same principles apply equally to the construction of any earth fill where construction specifications include degree of compaction and water content requirements.

PMP and the History of HMRs

INSTRUCTOR Edward M. Tomlinson, Ph.D., Atmospheric Science Consultants, LLC

OBJECTIVE Probable Maximum Precipitation (PMP) is used to compute the Probable Maximum Flood (PMF) that in turn is used by federal and state regulators to evaluate the safety of dams. The concept of an upper limit for precipitation was presented in the 1940’s with procedures for determining PMP values developed by the Weather Bureau (now the National Weather Service), the US Army Corps of Engineers, and the Bureau of Reclamation. The definition of PMP will be presented and discussed along with how theoretical values for PMP are determined. A brief historical review of Hydrometeorological Reports (HMRs) along with discussions on the evolution of PMP determination procedures in the current HMRs from HMR 49 to HMR 59 will be provided. A summary of the steps followed will be presented along with examples of the procedures used. Lastly, the differences between generalized and site-specific PMP will be discussed. Questions related to the HMRs and site-specific PMP studies will be addressed.

Potential Failure Mode Analysis as a Dam Safety Tool Part I: Introduction to PFMA

INSTRUCTOR Douglas D. Boyer, P.E., CEG, Federal Energy Regulatory Commission

OBJECTIVE Failure mode evaluation or what now is more commonly referred to as potential failure mode analysis (PFMA) for dam safety has become routine practice for many in the profession. The process became more formally organized through the US Bureau of Reclamation in the early to mid-1990’s and gained wider industry exposure in the early 2000’s through the publication of FERC’s Engineering Guidelines, Chapter 14 – Dam Safety Performance Monitoring Program. The PFMA process systematically identifies, describes, and evaluates ways a dam and its appurtenances could fail under all postulated loading conditions. However, a PFMA is much more than an exercise to evaluate and document potential failure modes for a dam. At its fullest extent, a PFMA is a valuable tool which can be used to guide and inform dam safety personnel on where to focus dam safety observations and inspections, where to strategically perform an investigation or install instruments to monitor dam performance, and can be used as a first step in a risk analysis. The process and results of the PFMA can also help to identify and prioritize O&M deficiencies, identify the need for improved operational processes, and pinpoint training needs. PFMAs can benefit dam owners and regulators by providing a better understanding and appreciation of potential structural and operational weaknesses and operating procedures. Finally, they may also be used to better inform downstream emergency management personnel of the hazards posed by the dam, while also providing a better understanding of effective evacuation protocols. This training webinar is being taught in two parts. Part I – Introduction to PFMA is an introductory “how to” session for folks who are not familiar with PFMAs or who have never done a PFMA. It will cover the basics of what a PFMA is, how it is typically structured, what information is required, who should be present, how to ‘brainstorm’ and evaluate PFMs, and what information from the PFMA session should be captured and documented in a report. Examples will be provided, both good and not so good, of potential failure mode sessions and reports. Part II – Application of PFMA in Dam Safety focuses on what to do with the results of a PFMA. Examples are provided of how the results of a PFMA can be integrated into everyday dam safety processes and can be used to inform and improve dam safety activities and decision-making.

Putting Public Safety First – The Oroville Dam Spillways Emergency Recovery


OBJECTIVE Starting in May 2017, DWR and its construction contractors began repairing and rebuilding Oroville’s main and emergency spillways. By November 1, 2018, the main spillway was successfully reconstructed, meeting DWR’s public safety
construction milestone. Work on the emergency spillway was completed soon afterwards. More than 1,000 people worked more than 2 million hours to rebuild the Oroville spillways to ensure the safety of downstream communities. This webinar will provide an orientation to Oroville Dam and the State Water Control Project, discuss the February 2017 incident and present the immediate recovery response, as well as the permanent modifications made to the main spillway and the Emergency Spillway.

Quality Assurance and Field Inspection for Dam Construction Projects

INSTRUCTOR Joe Freeland, P.E., USDA-NRCS

OBJECTIVE Quality control on projects for the construction or rehabilitation of dams is the responsibility of the construction contractor. Contractors have control of the site during construction and are responsible for understanding and complying with the requirements of the contract documents. It would be remiss on the part of the owner however, to solely rely on the contractor for this task. To verify contract compliance, construction of complex and potentially hazardous projects demands a high level of independent observation, oversight, and quality assurance measures by the owner or his designated engineer. Quality assurance measures are also often monitored by state and federal regulators. This webinar presents an introduction to the construction inspection/quality assurance process employed for new dam and dam rehabilitation projects to ensure that they are constructed as designed and to verify that the contractor complies with the terms and conditions of the contract. It will look at important items to inspect during construction and discuss the roles and responsibilities of the inspector. The construction inspection/quality assurance process presented will be of interest to dam owners, design engineers, state and federal regulators, and contractors.

Rainfall and Dam Safety – From PMP to the 100-Year Storm

INSTRUCTORS Bill D. Kappel and Douglas M. Hultstrand, Applied Weather Associates

OBJECTIVE Understanding how extreme storms and their precipitation are analyzed is critically important for dam design and dam safety. This webinar will detail the background of PMP and storm analysis starting with the earliest work completed by the US Weather Bureau (now National Weather Service) and continuing through current statewide and site-specific PMP work. Data and methods used to quantify rainfall spatially, temporally, and in magnitude will be discussed. Information on how these data are applied to create return frequencies of rainfall data and the limitations of such values will be discussed. Details on recent advances, such as the use of NEXRAD weather radar and GIS, will be discussed in relation to storm analysis and PMP development, and comparison will be provided against legacy documents such as Technical Paper 40, NOAA Atlas 2, and NOAA Atlas 14. Specific storm examples, which are important for dam safety design, will be discussed in detail. This will include information about the reliability of the original rainfall analyses and how that affects dam design and safety. Information related to the storms and their relationship to both return frequencies and climate change will be provided. The intent of this webinar is to provide non-meteorologists, hydrologists, engineers, and others involved in dam safety and design an understanding on the background of storm analysis, how they are used in PMP development, and how those data are used for precipitation frequency analysis. The attendee should come away with an understanding of the uncertainty and sensitivity involved in the PMP process, which will allow the users to apply the data and make more informed decisions both in the design of structures reliant on rainfall information and regulators to make more informed decisions regarding dam safety.

RCC Applications in Dam Engineering – What We Have Learned and What’s New

INSTRUCTOR Kenneth D. Hansen, P.E., Consultant

OBJECTIVE This webinar will focus on the many applications of RCC in dam engineering, including RCC dams, RCC overtopping protection, and RCC use in cofferdams. Other topics to be covered will be RCC for raising and rehabilitating existing concrete dams and RCC for grade control structures and stilling basin erosion protection. Emphasis will be placed on small to medium volume RCC projects including hints on cost effective design and estimating. In addition to presenting a basic introduction to RCC, case studies will be presented to illustrate the performance of RCC dams with respect to thermal induced cracking and earthquake resistance. In many cases, “Analysis vs. Reality” will be explored. Performance of RCC overtopping protection when subjected to infrequent overflows or day-to-day weathering will be discussed, including potential solutions. The main objective of the course will be to upgrade the attendee’s knowledge of the many potential uses of RCC in dam engineering and new developments in applying this construction method in order to prepare more cost effective, better performing designs.

Reexamination of the 2004 Failure of Big Bay Dam, Mississippi

INSTRUCTOR Keith A. Ferguson, P.E., DWRE, HDR Engineering, Inc.

OBJECTIVE This webinar will review the 2004 failure of Big Bay Dam. A potential failure modes framework was used to make the forensic root-cause assessment based on data and information provided by the state of Mississippi. A detailed timeline of the failure obtained through review of court proceedings will be presented including the appearance of a number of distress indicators, the seriousness of which were not recognized and acted upon by the owner and the owner engineer. Of particular interest is the influence of piping and erosion of highly erodible fine sandy silt and silty fine sand through open defects in the outlet works conduit. The full failure mode likely developed through a series of backward erosion initiation/continuation cycles that began under the upstream slope of the dam and moved toward the downstream end of the conduit over a period of about thirteen years. The rapidity of the final steps in the failure mode development leading to breach of the dam are quite stunning and serve to reinforce the importance of detecting and mitigating seepage distress in embankments as early as possible in the development process and prior to later stages of continuation/progression when adequate time or intervention methods are not available to stop the failure process. A generalized risk analysis event tree of the failure mode will be presented and described.

Rehabilitation of Concrete Dams

INSTRUCTOR Robert A. Kline, Jr., P.E., Gannett Fleming, Inc.

OBJECTIVE This webinar is the third and final course in the series on concrete gravity dams. The first webinar entitled “Introduction to Concrete Gravity Dams” (July 2012) presented information regarding the types of gravity dams, historic design, and construction practices, as well as lessons learned from noteworthy gravity dam failures. The second webinar in this series entitled, “Stability Evaluations for Concrete Dams” (Oct. 2013) presented information regarding potential failure modes, material properties, loading cases, federal agency criteria, and stability analysis methods. This webinar will start with a brief recap of these first two webinars and then present successful methods for improving the structural stability of existing concrete gravity dams. These methods can consist of either structure or foundation improvements or a combination of both. Relevant design details in applying these methods will also be covered. Since most concrete gravity dams built in the United States pre-date modern
design methods, many still require stability improvements. This webinar is meant to help dam owners, regulators, and designers better understand the options available for such improvements and best practices in applying them.

**Rehabilitation of NRCS Watershed Structures – a Consultant’s Perspective**

**INSTRUCTORS** Tyler Coats, P.E. and J.R. Collins P.E., Schnabel Engineering

**OBJECTIVE** This course will focus on the history, process, and technical requirements of the National Watershed Rehabilitation Program and, more specifically, a review of key technical requirements associated with the design and investigation of dams and spillways following Natural Resource Conservation Service (NRCS) guidance for rehabilitation of those structures. The typical alternatives considered to correct deficiencies will be presented.

**Relearning How to Look at Piezometric Data for Seepage Evaluation**

**INSTRUCTORS** Richard S. Olsen, Ph.D. P.E., Geotechnical Consultant

**OBJECTIVE** This webinar will start with the most basic seepage concepts and finalize on actual evaluation of piezometric data for earth dams and levees. Simple basic seepage ideas using high graphic illustrations will be the means to teach all concepts in this webinar. Also, numerous difficult concepts will be fully explained using high graphic simple illustrations. For example, this course will also provide unique insight into how seepage changes with simple geologic layer variations. A procedure for evaluating time based piezometric data versus reservoir data will be presented and it represents the only comprehensive method — the conventional procedure is to plot the data and then just look at it. This course also provides concepts for observing the potential for backward erosion using actual piezometric data. New procedures and standards for data presentation of field based piezometric data versus reservoir level will also be shown.

**Responding to Dam Emergencies**

**INSTRUCTOR** Paul Schweiger, P.E., Greg Richards, P.E., Gannett Fleming, Inc.

**OBJECTIVE** Many dam failures have been averted by dam owners and engineers taking quick and effective action to intervene and stop an active dam failure from progressing. The focus of this webinar is to present the most common failure modes at dams and provide information on actions that can be taken to prevent or delay each failure mode. Case studies will be used to show examples of successful interventions. Actions that could potentially do harm and make conditions worse will also be discussed. The seminar will conclude with an overview of the new “Dam Intervention Toolbox” and how this interactive resource can be used as a companion to an Emergency Action Plan to help dam owners be better prepared to respond to a dam emergency.

**Review of 1938 Construction Slide at Fort Peck Dam**

**INSTRUCTOR** Keith A. Ferguson, P.E., HDR Engineering, Inc.; and Laila M. Berre, P.E., US Army Corps of Engineers

**OBJECTIVE** This webinar will review the 1938 construction failure of the upstream slope of Fort Peck Dam, Montana. The failure began at about 1:35 PM on September 22, 1938 as the construction work progressed to within 20 feet of the final dam crest elevation. One hundred eighty men were working in the area. Thirty-four men were injured. Eight men lost their lives, six of whom were never found and are buried somewhere in the dam.

This webinar will be presented in two parts. The first part will cover the background of the project through the reconstruction of dam in the area where the slide occurred and the early performance of the dam following first filling of the reservoir. Part II explores the broader technology and human factors that influenced the design and post failure investigation, including the controversies that the expanded Board of Consultants encountered in preparing a report on the cause of failure and in reviewing the redesign of the portion of the dam that failed. This part begins with a discussion of the differences of opinions about technical matters that were revealed in the project literature. It presents a summary of the state of the practice at the time of design and construction, and briefly traces technology advances during the next 40 years following the slide. This includes a discussion of evolution of technology related to the shear strength of shales, and the liquefaction of sands.

**Risk Assessment Basics for an Individual Dam**

**INSTRUCTOR** David S. Bowles, Ph.D., P.E., P.H., D.WRE, F.ASCE, RAC Engineers and Economists, LLC

**OBJECTIVE** There is a growing recognition of the value of using risk assessment as a supplement to traditional engineering approaches to dam safety decision making. This is referred to as a risk-informed approach in which decision-making utilizes information obtained from a risk assessment along with other factors, including good engineering practice. Thus, a risk assessment is not the sole basis for a decision, but rather it provides a systematic way of identifying what is important and where uncertainties exist. Risk assessment can also be valuable for justifying the extent and type of risk reduction and the phasing of risk-reduction measures. This webinar will provide an explanation of the steps involved in performing a risk assessment for an individual dam and how the resulting insights and risk estimates can improve decision-making. Examples will be provided for evaluating an existing dam and for selecting between risk-reduction alternatives.

**Risk Assessment for Levee Projects**

**INSTRUCTOR** Scott Shewbridge, Ph.D., P.E., P.G., U.S. Army Corps of Engineers

**OBJECTIVE** The USACE has been conducting economic risk analyses for evaluating benefit cost ratios for levee projects since the 1960s. With a new focus on life safety, these same analytical techniques are now being used to evaluate priorities for infrastructure investments and required design reliability to achieve various goals, including National Economic Development and life safety risk reduction. This webinar will look at how the USACE is integrating traditional probabilistic levee fragility assessments, as described in ETL 1110-2-556 (Risk-Based Analysis in Geotechnical Engineering for Support of Planning Studies, 1999), with event-tree based system-response / fragility curve development process described in the joint USBR/USACE Best Practices in Dam and Levee Risk Analysis (2015) to evaluate levee system risk and risk reduction alternatives.

**Risk Communication for Dams**

**INSTRUCTOR** Kellie Mullen, Senior Vice President/Communications Coach & Trainer

**OBJECTIVE** Communication is important in all aspects of dam safety within an organization, with the public, and with the specific owners or stakeholders of a project. Risk communication and stakeholder participation should ensure that (1) responsible and impacted stakeholders will be partners and be afforded...
the opportunity to participate in decisions that impact them, and (2) communications regarding potential inundation hazard, consequences, and shared solutions will be open, transparent, and understandable. A focus on communicating the benefits and risks associated with dams to stakeholders and the public can help increase awareness of potential dam safety issues and help all parties gain a greater understanding of how dams impact their community. This creates an understanding of risk and dam safety issues important for those with varying degrees of connections to the dam; these diverse groups have a variety of backgrounds, experience, and sophistication.

Risk Management for a Portfolio of Dams

INSTRUCTOR David S. Bowles, Ph.D., P.E., P.H., D.WRE, F.ASCE, RAC Engineers and Economists, LLC

OBJECTIVE There is a growing recognition of the value of using risk assessment as a supplemental to traditional engineering approaches to dam safety decision making. This is referred to as a risk-informed approach in which decision making utilizes information obtained from a risk assessment along with other factors, including good engineering practice. Thus, a risk assessment is not the sole basis for a decision, but rather it provides a systematic way of identifying what is important and where uncertainties exist. Risk assessment can also be valuable for justifying the extent and type of risk reduction and the phasing of risk-reduction measures. The first webinar, “Risk Assessment Basics for an Individual Dam,” provided an explanation of the steps involved in performing a risk assessment for an individual dam and how the resulting insights and risk estimates can improve decision making. Examples were provided for evaluating an existing dam and for selecting between risk-reduction alternatives. This webinar will explain how risk assessment is being used by some owners and regulators to improve the management of dam safety for a portfolio of dams in the context of the owner’s business. The role of risk assessment in strengthening both routine and non-routine dam safety activities will be described. The use of risk assessment for prioritized queues of investigations and risk-reduction measures to achieve more rapid and cost-effective risk reduction will also be described. Examples will be provided of ways in which portfolio risk assessment has led to improving the integration of dam safety with other parts of the owner’s business, such as insurance coverages and increased funding for dam safety.

Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures

INSTRUCTORS Dr. Donald A. Bruce, Geosystems, LP

OBJECTIVE This webinar reviews the principles of rock grouting for new and remedial dam projects. Since the mid-1990s, there have been significant developments in rock grouting technology. Although these advances have been largely driven by the challenges of remedial grouting projects and in particular those in karstic terrains—the developments are being implemented in foundation treatments for new dams also. This webinar reviews contemporary approaches to design, construction, QA/QC, and verification. These apply to both blanket and curtain grouting applications.

Rock Grouting Principles for New and Remedial Dam Projects

INSTRUCTORS Michael F. George, BGC Engineering, Inc.; and George Annandale, George W. Annandale, Inc.

OBJECTIVE Erodibility of dam foundations, spillways and other water conveyance structures is a critical issue for the safe operation of dams world-wide. The February 2017 events at the Oroville spillways that resulted in the evacuation of nearly 200,000 downstream residents were a recent reminder of the need for meaningful quantification of scour. The course will offer examples of rock scour events impacting the safety of dams as well as provide an overview of scour mechanisms including discussion of key geologic controls and hydraulic drivers of the scouring process. Methods that can be reliably used to predict and assess such scour will be demonstrated, which include the Erodibility Index Method, a semi-empirical approach, and a more physics-based approach utilizing Block Theory. Both methods analyze the engineering properties of the rock mass and quantify the erosive capacity of flowing water based on principles of hydraulic engineering. These methods will be explained, and their use illustrated by example. Finally, incorporation of high-resolution remote sensing tools in scour applications will be explored.

Roller Compacted Concrete – Design and Construction of Water Control Structures

INSTRUCTOR Randall P. Bass, P.E., Schnabel Engineering

OBJECTIVE This webinar will provide a general overview of the development of RCC and how this material is being used in dams and spillways. Recent design and construction trends will be presented in the areas of mix designs, jointing, facing systems, and placement procedures. The primary topics of this webinar are the development of RCC, mix proportioning to develop fresh and harden properties, applications during the first 31 years, construction means and methods, and performance.

Seepage Monitoring and Analysis of Embankment Dams

INSTRUCTOR Mark W. Pabst, P.E., Geotechnical Engineering

OBJECTIVE Some amount of seepage passes through and under all embankment dams. The collection, monitoring, and analysis of seepage is crucial in the successful execution of any dam safety program and is helpful in deciding if it is expected ambient seepage or indicative of a more serious condition. Seepage collection methods typically include toe drains, blanket drains, and relief wells. Monitoring schemes can be grouped into several categories, including pressure, flow, temperature, and chemistry. Commonly used methods to collect data from these methods, one then conducts an analysis to determine if the performance meets ‘design intent’ or if it indicates the dam is in distress and repair is required. Since all dams and their foundations are different, there is no standard methodology for analysis and these studies tend to be ‘investigative’ in nature. This course will provide a background on collection methods, and instruments will be made, including typical presentation methods. Finally, an overview of analysis methodologies will be presented, as well as two case histories.

Seepage Rehabilitation for Embankment Dams

INSTRUCTORS John W. France, P.E., D.GE, D.WRE, JW Consulting, LLC, and Jennifer L. Williams, P.E., AECOM

OBJECTIVE This webinar will review the current state of the practice for rehabilitation of embankment dams to address seepage issues. Seepage rehabilitation measures can generally be grouped into two categories: seepage reduction / limitation measures and seepage collection measures. Seepage reduction / limitation measures include such features as foundation grout curtains, low permeability blankets, and seepage barrier walls. These measures are intended to reduce or limit the amount of seepage that occurs through, beneath, and around a dam. Seepage collection measures include such features as blanket drains, toe drains, chimney filters / drains, and relief wells. These
measures are intended to collect seepage which occurs in a manner that maintains stability of the dam and prevents internal erosion. All these measures will be reviewed along with discussion of their appropriate applications. Case studies and examples will be used to highlight the applications of the various methods.

**Seismic Stability Evaluation of Earth Dams**

**INSTRUCTORS** Lelio H. Mejia, Ph.D., P.E., G.E., AECOM; and Richard J. Armstrong, Ph.D., P.E., California Division of Safety of Dams

**OBJECTIVE** Earthquakes represent a hazard to dams in many parts of the United States and therefore are of interest to design engineers and dam safety officials. Evaluation of the seismic stability of these dams to future anticipated earthquakes require an understanding of seismic hazards, site exploration methods, soil behavior under seismic loading, and seismic stability analysis techniques. This webinar will cover the fundamentals of these topics to provide design engineers and dam safety officials with basic knowledge to help in the analysis and review of seismic analyses of earth dams. Topics covered include: examples of seismic performance of embankment dams, selection of applicable evaluation procedures, liquefaction evaluation, cyclic softening evaluation, soil strength, and seismic stability analysis. Key concepts to understand will be presented for each topic with examples to demonstrate the application of these concepts to practice.

**Selection for Static Slope Stability Analysis**

**INSTRUCTORS** Christina J. Winckler, P.E., AECOM; and John W. France, P.E., D.GE, D.WRE, JW Consulting, LLC

**OBJECTIVE** This webinar will provide practical guidance on the selection of soil shear strength parameters for static slope stability analysis. Topics covered include stress-strain behaviors of cohesionless and cohesive soils and their relationships to strength selection, drained and undrained strengths and their application in stability analysis, the differences between effective stress and total stress analysis methods, loading cases for stability analysis and appropriate strength selection for each case, and methods for selection of strength parameters from field and laboratory data.

**Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment**

**INSTRUCTORS** Khaled Chowdhury, Ph.D, P.E.G.E., US Army Corps of Engineers and Raymond Seed, Ph.D, University of California at Berkeley

**OBJECTIVE** Seismic analyses of foundation soils and earth structures such as embankment dams, levees, and structural fills, as well as soil-structure interaction issues associated with buildings and bridges, lifelines, and port and harbor facilities, are used to reliably predict expected seismic performance and depend on a number of important factors. Over the past several decades, significant advancements have occurred in seismic hazard assessment and approaches, protocols, and computing capabilities for analysis and numerical modeling. However, in the absence of suitable site characterization and parameter development, modern seismic analyses, including seismic deformation analyses, could result in incomplete and/or potentially dangerously misleading assessments regarding the expected seismic performance of an embankment dam or other critical infrastructure during an earthquake. This webinar will focus on important aspects of site investigations and parameter development for seismic deformations analyses.

**Sliplining Low-Level Conduits**

**INSTRUCTORS** J. Tyler Coats, P.E. and Joseph S. Monroe, P.E., Schnabel Engineering, LLC

**OBJECTIVE** Low-level conduits (pipes) through the base of a dam are the most common spillway for small earthen embankment structures. However, the discontinuity caused by the presence of the conduit creates numerous issues that must be addressed during the design and construction of the low-level pipe. This short course will present general design and construction-related issues that dam engineers and owners should be aware of when considering a low-level conduit in their earthen embankment structure. Seepage control, structural integrity, and material life expectancy will be discussed. In addition, the course will also discuss issues that occur after the impoundment is filled, items that need to be observed/monitored, and possible remedial actions once a deficiency is documented.

**Slope Stability Modeling for Embankment Dams: Planning, Interpreting, and Reporting Results**

**INSTRUCTORS** Kevin Ritter and Harry C. Donaghy, AECOM

**OBJECTIVE** Slope stability analyses can be used to evaluate the performance of an existing dam, design a new dam, or design a dam safety modification. But, like all models, the output is only as good as the input. This webinar will discuss how to effectively plan for and implement slope stability analyses such that the result meets the objective.

**Specialty Construction Techniques for Foundation Improvement and Seepage Reduction**

**INSTRUCTOR** Dr. Donald A. Bruce, Geosystems, LP

**OBJECTIVE** This course reviews the applicability of the wide range of specialty geotechnical construction techniques used in rock and soil foundations under dams and levees. These techniques are employed to provide seepage reduction and improve soils susceptible to seismicity or are otherwise too weak to sustain embankment rebuilding projects. The world of grouting alone is very wide, ranging from rock fissure and void grouting to permeation and compaction grouting in soils. The Deep Mixing Methods (DMM) are similarly diverse and are used to form cut-offs and shear panels for both seismic and static improvements. So-called “positive” cut-off walls are constructed by several methods, including the use of clamshells, hydromills, and secant piling. Each of these techniques is described, illustrated by major U.S. dam and levee remediation case histories.

**Spillway Conduits – More Than Just a Pipe Through the Dam**

**INSTRUCTOR** Joseph S. Monroe, P.E., Schnabel

**OBJECTIVE** Low-level conduits (pipes) through the base of a dam are the most common spillway for small earthen embankment structures. However, the discontinuity caused by the presence of the conduit creates numerous issues that must be addressed during the design and construction of the low-level pipe. This short course will present general design and construction-related issues that dam engineers and owners should be aware of when considering a low-level conduit in their earthen embankment structure. Seepage control, structural integrity, and material life expectancy will be discussed. In addition, the course will also discuss issues that occur after the impoundment is filled, items that need to be observed/monitored, and possible remedial actions once a deficiency is documented.
**Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions**

**INSTRUCTORS** Mathew Moses, P.E., and Layne Bukhair, P.E., Freese and Nichols, Inc.

**OBJECTIVE** This webinar will cover lessons learned in gate rehabilitation projects and issues associated with deciding between a rehabilitation project and a gate replacement project. Dewatering options for a spillway gate rehabilitation project will be discussed. Many times, the extent of the rehabilitation issues is unknown until the gate has been dewatered and the seals and coatings have been removed. Rehabilitation can range from relatively straightforward seal replacement and recoating to more complicated member strengthening or cutout/replacement and trunnion anchorage strengthening, and these efforts will be discussed. Other items to be discussed include seal hardware, installation and adjustment, procedures for testing the gate for leakage, field inspections, and commissioning following a rehabilitation project.

**Stability Evaluations of Concrete Dams**

**INSTRUCTORS** Robert A. Kline, Jr., P.E., and Guy S. Lund, P.E., Gannett Fleming, Inc.

**OBJECTIVE** Historically, concrete dam analysis focused much of the attention on material property assumptions, which has been and continues to be important. But more recently, the focus is primarily on the modes of failure experienced by these types of dams. This webinar will present a more in-depth review of stability evaluation methods for concrete dams; the basics of which was first presented in the previous webinar entitled, “Introduction to Concrete Gravity Dams.” Other topics consist of: concrete dam construction and potential failure modes, material properties, loading cases, current federal agency criteria, stability analysis methods, simple gravity method, and finite element methods. The purpose of this webinar is to familiarize practitioners with the current state-of-the-practice in evaluating the stability of concrete dams. This webinar will begin with a brief overview of the origins of rational design methods previously presented in “Introduction to Concrete Gravity Dams.” Other topics consist of: concrete dam construction and potential failure modes, material properties, loading cases, current federal agency criteria, stability analysis methods, simple gravity method, and finite element methods. The purpose of this webinar is to familiarize practitioners with the current state-of-the-practice in evaluating the stability of concrete dams.

**Stepped Chute Spillway Design for Embankment Dams**

**INSTRUCTOR** Sherry L. Hunt, Ph.D., USDA-ARS

**OBJECTIVE** Changing demographics in the vicinity of dams has led to hazard creep in a number of dams worldwide. Many of these dams now have insufficient spillway capacity as a result of these changes in hazard classification from low to significant or high hazard. Stepped chutes applied to the embankment dams offer an advantage by providing increased spillway capacity. This webinar provides an overview on stepped chute design conducted at the USDA-Agricultural Research Service (ARS) Hydraulic Engineering Research Unit in Stillwater, OK. Scientists have developed relationships and compared them to those available in literature for the design of stepped chutes applied to embankment dams.

**Stream Management for Dam Construction**

**INSTRUCTOR** Daniel (Dan) Johnson, Daniel Johnson Consultants, Inc.

**OBJECTIVE** Rehabilitation of dams may involve access to the upstream side of the dam. Under such conditions, management of the river to keep the upstream area dry for construction activities is required. Cofferdams are typically used to capture river discharges and route to the bypass. Cofferdam design typically involves agreed upon criteria that is a balance between performance and cost, requiring an evaluation of risk specific to a site. Many cofferdams have failed by breaching during construction of dam projects, mainly by having the design flood exceeded. This webinar will present approaches to stream management including design approaches, assignment of risks, and separation and/or sharing of responsibilities.

**Structural Condition Assessment of Dam Facilities with Non-Destructive Evaluation Methods**

**INSTRUCTOR** Larry D. Olson, P.E., Olson Engineering

**OBJECTIVE** The webinar will discuss the basics of various non-destructive evaluation (NDE) methods and their applications for investigating dam, spillway and conduit conditions such as freeze-thaw cracking, void, seepage, corrosion of reinforcing, anchor bolts, strength/moduli, and stability. Guidance will be provided as to which NDE methods are useful for diagnosing various conditions of concrete, masonry, earthen, and steel materials. The webinar will highlight the important aspects of each phase from planning of NDE investigations and the basics of the NDE methods in terms of testing and analysis.

**Terminal Structures and Energy Dissipation at Outlet Works and Spillways**

**INSTRUCTOR** K. Warren Frizell, Research Hydraulic Engineer

**OBJECTIVE** Effective energy dissipation of flows from outlet works and spillways is an extremely important component in dam safety. Undersized or ineffective structures can lead to damage and failure, possibly endangering the dam or the flow channel and properties downstream. Generalized design criteria for many different types of energy dissipaters and/or stilling basins exist from several different government agencies, both federal and state (including many state dam safety offices). This webinar will introduce the problem of why energy dissipation is necessary, a review of the many types of structures and their application, specialized designs, typical operations and problems, and where to find more information.

**Teton Dam – The Failure That Changed an Industry**

**INSTRUCTORS** Richard Lee, P.G., Quantum Geophysics a Division of Gannett Fleming, Inc.; and Scott Burch, P.E., Gannett Fleming, Inc.

**OBJECTIVE** While there have been many notable dam failures throughout the past century, the failure of Teton Dam in 1976 led to significant changes at the Bureau of Reclamation, in the federal government, and in the dam engineering industry. This course will provide information about the dam, the failure, ensuing investigations, and the changes that were implemented in the years that followed.

**The History of Dam Safety Governance in the US Including Risk Analysis**

**INSTRUCTOR** Keith A. Ferguson, P.E., HDR Engineering, Inc.,

**OBJECTIVE** This webinar will review the history of dam safety governance development in the US from 1876 to present day. The governance development timeline will place key failures and incidents into perspective and show how such events triggered state and federal laws and the development of risk analysis methods and best practices that form a key cornerstone of dam safety practice.
The origin of risk analysis related to dams and dam safety trace back to the mid-1960’s. The initial vision for risk that was presented as part of the 2nd Terzaghi lecture (delivered by Arthur Casagrande in 1965) will start our exploration of the risk analysis and risk assessment timeline embedded within the overall US dam safety governance system. The provision for risk analysis that was embedded within the first federal guidelines for dam safety and the Reclamation Safety of Dams Act of 1978 (PL 95-578) will be discussed, along with how risk analyses emerged within various federal agencies (USBR, USACE, TVA, and the FERC) and the expanding role of risk within state dam safety programs.

**The Practical Use of Geophysics to Assess Dam and Levee Safety**

**INSTRUCTORS** Richard Lee, P.G., Principal Geophysicist and President of Quantum Geophysics a Division of Gannett Fleming, Inc.; and Scott Burch, P.E., Southeast Dams & Hydraulics Practice Leader, Gannett Fleming, Inc.

**OBJECTIVE** The webinar consists of two sessions. Session 1 is an overview of geophysical methods applicable to dams and levees, theory behind the methodologies, and the strengths and limitations of each method. This session will also cover what additional investigations, such as drilling, are necessary to calibrate the geophysical data in order to provide a holistic evaluation of the subsurface conditions and how these conditions can affect dam and levee safety. Session 2 will be an in-depth case study of how a particular geophysical method, MASW (Multi-Channel Assessment of Surface Waves) was used to assess subsurface conditions and potential levee safety concerns for the East Coast Protection Levee System in South Florida.

**The State of the Practice and Future of Dam Breach Modeling**

**INSTRUCTOR** Amanda J. Hess, P.E., CFM, Gannett Fleming, Inc.

**OBJECTIVE** This course will survey dam breach analysis methods currently in use. Differences in methodology, analysis steps, assumptions, and results will be described. Specifically, the course will focus on hydrologic routing of dam breach flood waves, 1D hydraulic routing, and 2D hydraulic routing. Features of popular software will be summarized and the future of dam breach modeling will be discussed based on current trends.

**Tolerable Risk Guidelines for Dams: How Safe is Safe Enough?**

**INSTRUCTOR** David S. Bowles, Ph.D., P.E., P.H., D.WRE, F.ASCE, RAC Engineers and Economists, LLC

**OBJECTIVE** Tolerable risk guidelines are used to guide the process of evaluating whether dam safety risks are low enough. They provide a means of relating dam safety risks to other risks to which people are exposed as a result of technological hazards. While these guidelines should not be used as the only basis for dam safety decisions, they can play a useful role in making the case for a decision. This webinar will provide both examples of practical applications of USACE and Reclamation tolerable risk guidelines and a summary of the principles that underlie the basis for tolerable risk guidelines. The examples will be for existing dams and for the evaluation of risk reduction alternatives. They will be based on almost 20 years of experience with applying tolerable risk guidelines in several countries in support of real-world dam safety decisions. Variations in dam safety tolerable risk guidelines in several countries will be discussed. Implementation issues such as considering uncertainty in risk estimates and practical ways to build legal defensibility through considering if risks have been reduced as low as reasonably practicable will be discussed. In addition, examples of tolerable risk guidelines will be provided from other fields such as environmental protection, nuclear safety, transportation safety, and land-use planning.

**Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees**

**INSTRUCTOR** Gregory Zamensky, P.E., Black & Veatch Corporation

**OBJECTIVE** Plant and animal intrusions represent a common but often overlooked threat to the long-term safety of embankment dams throughout the U.S. In fact, these hazards have been attributed to dam failures and near dam failures in the past. Proper identification, treatment, and long-term management of these dangers are important to the overall health of embankment dams. This webinar will provide engineers, owners, and dam safety officials with an understanding of these concepts to help everyone participate in the safety of embankment dams. This webinar will cover both plant and animal intrusions in embankment dams. Topics covered include: the identification and diagnosis of problematic situations; typical treatment methods; and strategies for preventing problems in the future.

**Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees – Part II**

**INSTRUCTOR** Leslie F. Harder, Jr., Ph.D., P.E., G.E., HDR Engineering, Inc.

**OBJECTIVE** This two-hour webinar builds upon a previous webinar given in 2015 and highlights the results of recent research and policies developed with respect to plant and animal intrusions into dam and levee embankments. Intrusions by plants and animals into water-retaining embankments have long been of concern for potentially degrading the integrity of these structures. Concerns have ranged from the potential for increased seepage and concentrated leak erosion to reducing the overall embankment cross-section due to tree blowers. However, successfully managing such intrusions has often been difficult. Recent research provides improved insight on the relative risks of such intrusions as well as where they might be expected and potential mitigation methods for them. The guidance provided in this webinar continues to support the removal of all woody vegetation from embankment dams, particularly those embankment dams that commonly retain water. However, more nuanced approaches are outlined for the management of woody vegetation on levees. Specific remediation measures are discussed for both plant and animal intrusions together with their likely success.

**Understanding Static Liquefaction**

**INSTRUCTOR** John W. France

**OBJECTIVE** Static liquefaction is the brittle loss of strength in loose, saturated, nonplastic or low plasticity soil under monotonic loading (i.e., static rather than dynamic). Research has conclusively demonstrated that, if static liquefaction is triggered, loose nonplastic soils can mobilize undrained shear strengths significantly less than the strengths associated with conventional drained effective stress strength parameters. Although static liquefaction has been studied for decades, it remains a phenomenon not well-understood in the dam safety community, and
it is rarely evaluated for water storage dams. In the mining industry,
the risks of static liquefaction for tailings impoundments have become
more widely recognized, particularly after static liquefaction was
cited as a likely root cause for the Brumadinho Dam failure in 2019.
More recently static liquefaction was cited as the cause of the May
2020 failure of Eden Pond Dam, MI – a hydroelectric dam. It is not widely
known that static liquefaction was previously cited as the root cause
for failures of multiple water storage dams including: Wachusett
Dam (1907), Calaveras Dam (1918), and Fort Peck Dam (1938). Static
liquefaction is a particularly dangerous potential failure mode because
it can occur very quickly with little or no warning signs.

This webinar will include discussion of the principles and mechanisms
of static liquefaction, case histories of static liquefaction, methods
for investigation and analysis of static liquefaction potential, and
thoughts on how this potential failure mode can be addressed by the
dam safety industry.

Underwater Installation of Geomembranes

INSTRUCTOR John Wilkes, P.E., CARPI USA

OBJECTIVE Rehabilitation of dams with geomembranes has
stopped seepage in more than 200 dams worldwide. In the 1990s,
the US Army Corps of Engineers recognized that geomembranes
could arrest seepage in many structures but many structures in the
U.S. could not be dewatered for installation. Subsequently, a 2-phase
design and testing program with the US Army Corps of Engineers
adapted geomembrane system details for underwater installation.
The first underwater installation occurred in 1997 at Lost Creek
dam in California, stopping the seepage through the dam for the
first time in 70 years. The Lost Creek project is still in service after
almost 20 years without any maintenance. Subsequent underwater
installations around the world have all been successful to stop
seepage, including installations exceeding more than 100,000 sq.
feet installed underwater. These underwater installations have relied
on using compression fittings to join geomembrane panels together
underwater. The underwater applications of geomembrane have also
been adapted to cover joints and cracks on dams. These applications
have been done in the USA, Canada, Italy, Greece, and Laos. For dams,
the water typically has no substantial flow. About 10 years ago, the
issue of repairing levees and canals became more important around
the world and many of these structures cannot be dewatered. After
years of research and development, a geomembrane system for
placing geomembrane panels underwater in flowing water during
operation has been developed. This advancement required the
development of a special watertight zipper. Then additional testing
was done to develop a complete system and deployment procedure for
these geomembrane panels. This system has now gone from testing
into implementation phase and promises to provide a mechanism
to fix leaking structures underwater even in flowing water. The first
test installations have been done on canals in Italy and Egypt. The
webinar will discuss the testing and installations along with results of
geomembrane systems installed underwater.

Uplift and Drainage for Concrete Dams and Spillways

INSTRUCTORS William R. Fiedler, HDR; and Gregg A. Scott, Scott
Consulting, LLC

OBJECTIVE This course will discuss the impact of uplift on concrete
dams and spillways, the benefits of drainage, the design of drainage
systems, and the evaluation of drainage systems. Case histories
related to drainage issues at concrete dams and spillways will also
be presented. Potential failure modes and considerations for risk
analyses will be discussed. Some of the topics that will be presented
include: 3D seepage effects on uplift, effects of grouting on pressure
reduction, failed waterstops and cracks in concrete, using piezometric
measurements to evaluate drainage and uplift, filters for drains, drain
cleaning, and the design and evaluation of supplemental drainage.

Use of Remote Sensing in Dam Safety –
Including Drones

INSTRUCTORS Chris Krebs, P.E., GISP, CFM, and Daniel Hunter, GISP,
Cannett Fleming Inc.

OBJECTIVE This course presents current technologies and discusses
the application of them to the dams community. It focuses heavily on
the integration of drone technology at dam sites but also on several
other technologies, including but not limited to 360-degree cameras,
mobile data collection, GNSS, and cloud computing resources.
Attendees will take away a greater understanding of what technology
can do for them and how they can implement each the next time they
are in the field.

Use of Underwater Remote Systems in Dam Safety

INSTRUCTOR Mark Stepanean, Pro-ROV Services, LLC

OBJECTIVE This course will include specifications on various pieces of equipment, both on the high and lower end of pricing, including benefits and shortcomings used during underwater inspections and surveys. These will range from ROV, AUV, wheeled and tracked crawlers, to different types of survey lasers and sonars (including deployment methods). We will cover the various types of hydrographic, LiDAR and photogrammetric survey methodologies and equipment, including single and multibeam bathymetric sonars, sidescan, sub-bottom and pipe profiling sonars, as well as magnetometers. Emphasis will be on how resultant datasets can be combined to form a complete multi-layer geo-referenced 3D deliverable for the client from the 10,000-foot level to sub-centimeter level. A large number of equipment, data, and deliverables will be shown, along with approximate costing for equipment, time expected on type of projects, and post processing.

Using Instrumentation for Dam Safety Monitoring

INSTRUCTOR Barry K. Myers, P.E., Engineered Monitoring Solutions

OBJECTIVE It is widely accepted that monitoring programs
are important for dam safety. Monitoring programs provide the
information necessary to understanding the on-going performance
of the dam, as well as the ability to detect a change in this
performance, which can be critical in identifying the need to take
actions to avoid the consequences of a dam failure. Monitoring
programs generally consist of visual observations and measurements
of specific parameters used by trained personnel to evaluate how
the dam is performing, and to detect conditions of concern that
may indicate a developing failure mode. The methods of making
the physical measurements vary from manual instrument readings
to automated data acquisition systems. The best approach will
depend upon the monitoring needs. On-going evaluation of the
monitoring results is also very important for a successful monitoring
program. The key is to manage the data and present the results in
a manner that is convenient and understandable for the reviewer.
This includes a comparison of the measured or observed results with
the expected performance for the dam. There are many tools that
are currently available to assist with the measurement, collection,
management, presentation, and evaluation of the monitoring results.
The most appropriate tool will depend upon the needs of the users.
The objectives of this course are to provide the participants with a
general understanding of 1) how instrumentation and data collection/management tools can be used to improve a dam safety monitoring program, 2) the tools that are currently available and how to apply them, 3) how to use a system design approach to successfully implement a monitoring system, and 4) guidance for installing, operating, and maintaining a monitoring system.
Waterproofing Systems for Dams

INSTRUCTORS  John Wilkes, P.E., and Martha Monserrate, P.E., CARPI USA

OBJECTIVE  The first geomembranes were installed on dams in 1959 in Italy and British Columbia: both systems were covered. In the 1970’s geomembranes began to be installed on dams. In the next 20 years, geomembrane systems were installed on more than 2 dozen dams, primarily in Europe. The first exposed geomembrane system on a dam in the United States was installed in 1997. The United States now has the largest installed base of exposed geomembrane systems on dams in the world and the overall world inventory has quadrupled in the last 20 years to more than 100 dams worldwide. This webinar gives an overview of the 2010 ICOLD Bulletin 135, “Geomembrane Sealing Systems for Dams” focusing on the evolving technology of exposed geomembrane sealing systems. The webinar begins with a summary of the materials, testing, and aging of geomembranes; different loads and physical considerations; and examples of installations on fill, gravity, masonry, and RCC dams, along with special applications on dam cracks/joints and underwater installations. The webinar will conclude with QC considerations for the geomembrane sealing systems along with guidance on technical and contractual specifications. The agenda will closely follow the ICOLD Bulletin 135 content.

What Can I Really Expect to Get Out of a Semi-Quantitative Risk Analyses (SQRA)?

INSTRUCTOR  Doug Boyer, RIDM Branch, Federal Energy Regulatory Commission

OBJECTIVE  Dam and levee safety risk analyses have been gaining more and more attention over the last few years. Risk analysis training, in general, and SQRA training, in particular, is becoming more available. Recently FERC published draft SQRA guidelines for public comment indicating a proposed expansion by that agency into using risk tools. Other federal agencies with dam and levee safety programs are also expanding the use of SQRAs in their programs as are a handful of state dam safety agencies. The growth of the use of SQRAs as a dam and levee safety tool is expected to continue to increase in the coming years.

Why Embankments Crack and How to Fix Them

INSTRUCTOR  Benjamin C. Doerge, USDA-NRCS

OBJECTIVE  This course is based on 50 years of NRCS experience with investigating and remediating cracked earth embankments. The presentation consists of two main sections, covering 1) the nature of soil cracking and the associated internal erosion failure modes; and 2) how to remediate cracked earth embankments. In the first section, general information is presented on which soils are most susceptible to cracking and which pose the greatest risk for failure by internal erosion. The most common causes of cracking are identified, along with descriptions of the associated cracking mechanisms and patterns. In the second section, the two main approaches to repairing cracked embankments are presented: the “cutoff” approach and the “filter” approach. Real life examples of each are presented. The use of geotextiles in repairing cracked embankments is discussed, including several case histories and an analytical procedure to design geotextiles to span open cracks. Finally, the issue of cracking of granular filters is discussed in terms of its incidence, risk, and prevention.

WinDAM – Overtopping and Internal Erosion for Earthen Embankments

INSTRUCTORS  Karl Visser and Jon Fripp, USDA-NRCS

WinDAM software estimates the erosion and breach outflows from overtopping flows and internal erosion flows affecting earthen embankments. This webinar will provide an overview of the WinDAM model and the various inputs needed. The webinar will also cover output from WinDAM. The webinar will target users and designers more than researchers.
Webinars by Category

CONSTRUCTION MANAGEMENT
- Concrete Construction – Issues and Remedies
- Dam Construction Quality Control – Dos, Don’ts, and Lessons Learned
- Dam Overtopping Protection Systems - Part 1
- Dam Overtopping Protection Systems - Part 2
- Designing Slope Protection for Dams and Levees
- Foundation Preparation and Treatment for Dam Construction
- Fundamentals of Concrete Construction Inspections for Dams and Appurtenant Structures
- Human Factors in the Oroville Dam Spillway Incident
- Intro to Tailings Dam and Coal Ash Impoundment Design, Construction, and Monitoring: What Can Go Wrong and Right?
- Introduction to Dam Decommissioning
- Improving the Dam Safety Design Review Process
- Managing Increased Dam Safety Risk During Reconstruction
- Quality Assurance and Field Inspection for Dam Construction Projects
- Rock Grouting Principles for New and Remedial Dam Projects
- Spillway Gates & Devatering Systems - Lessons Learned and Practical Solutions
- Stream Management for Dam Construction
- The Practical Use of Geophysics to Assess Dam and Levee Safety
- Use of Remote Sensing in Dam Safety Including Drones
- Waterproofing Systems for Dams

EMERGENCY ACTION PLANNING
- Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
- Designing Spillways to Mitigate Failure Modes
- Emergency Action Plan Basics
- Emergency Recovery
- Exploring Dam Breach Parameters: Observed and Modeled
- Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan
- How to Make Your Emergency Action Plan More Effective
- Human Factors in the Edenville Dam Failure
- Human Factors in the Oroville Dam Spillway Incident
- Judgment and Decision-Making in Dam Engineering
- Lake Level Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
- Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
- San Fernando Dams Performance Case Histories
- Teton Dam - The Failure That Changed an Industry
- The 1979 Machhu Dam Disaster: Social Origins and Social Consequences
- The State of the Practice and Future of Dam Breach Modeling
- WinDAM – Overtopping and Internal Erosion for Earthen Embankments

ENVIRONMENTAL ISSUES
- Extreme Precipitation and Dam Safety in a Changing Climate
- Human Factors in the Oroville Dam Spillway Incident
- Introduction to PFMA
- Introduction to Nature-Like Fishways for Dams
- Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
- Use of Underwater Remote Systems in Dam Safety

FAILURES, INCIDENTS AND INVESTIGATIONS
- Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
- Concrete Construction – Issues and Remedies
- Concrete Repair and Maintenance for Dams
- Current Trends in the Seismic Analysis of Embankment Dams
- Dam Overtopping Protection Systems - Part 1
- Dam Overtopping Protection Systems - Part 2
- Delhi Dam - A Compound Failure
- Designing Spillways to Mitigate Failure Modes
- Drone Technology Integrated into Dam Safety Inspections and Evaluations
- Emergency Intervention Toolbox
- Evaluation and Maintenance of Piezometers, Relief Wells, and Drains in Dams and Levees
- Exploring Dam Breach Parameters: Observed and Modeled
- Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan
- Findings of the Oroville Dam Spillway Forensic Investigation
- Human Factors in Dam Failure and Safety
- Human Factors in the Oroville Dam Spillway Incident
- Intro to Post-Tensioned Anchors for Dams
- Judgment and Decision-Making in Dam Engineering
- Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
- Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
- Low-Level Conduits - What Can Go Wrong, How to Inspect, How to Repair?
- Michigan Failures/Pandemic – Impacts to the ASDSO Peer Review Process
- Potential Failure Mode Analysis as a Dam Safety Tool Part I: Introduction to PFMA
- Putting Public Safety First - The Oroville Dam Spillways: Emergency Recovery
- Reexamination of the 2004 Failure of Big Bay Dam, Mississippi
- Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
- Relearning How to Look at Piezometric Data for Seepage Evaluation
- Responding to Dam Emergencies
- Review of 1938 Construction Slide at Fort Peck Dam
- Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures
- Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
- Slippaging Low Level Conduits
- Stability Evaluations of Concrete Dams
- Teton Dam - The Failure That Changed an Industry
- The 1979 Machhu Dam Disaster: Social Origins and Social Consequences
- The History of Dam Safety Governance in the US Including Risk Analysis
- The Fontenelle Dam Incident 1965
- Understanding Static Liquefaction
- Uplift and Drainage for Concrete Dams and Spillways
- Use of Underwater Remote Systems in Dam Safety
- WinDAM - Overtopping and Internal Erosion for Earthen Embankments

GEOTECHNICAL ISSUES
- Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
- 3-D Effects on Estimation of Gradients, Seepage Flows and Evaluation of Internal Erosion Potential Failure Modes
- Advances in Geologic Data Collection and 3D Geologic Modeling for Site Characterization and Safety Studies for Dams and Levees
- Cracking and Hydraulic Fracturing in Embankment Dams and Levees
- Current Trends in the Seismic Analysis of Embankment Dams
- Dam Overtopping Protection Systems - Part I
- Dam Overtopping Protection Systems - Part II
- Delhi Dam - A Compound Failure
- Drilling Plans and Hazard Evaluations for Dams and Levees
- Earthquake Hazards, Ground Motions and Dynamic Response
- Empirical Estimates of Permeability for Earth Dam Projects
- Evaluation of Seepage Related Potential Failure Modes (PFM/SA) in Embankments with Emphasis on Outlet Penetrations
- Field Investigations for New and Existing Dams
- Filter Design History and a One-Step Design Process
- Filters and Drainage Systems for Embankment Dams
- Foundation Cutoff Walls for Dams and Levees
- Foundation Preparation and Treatment for Dam Construction
- Guidelines for Assigning Erodibility Parameters to Soil Horizons for SITES analyses
- Human Factors in the Edenville Dam Failure
- Human Factors in the Oroville Dam Spillway Incident
- Improving the Dam Safety Design Review Process
- Instrumentation in Dams - Selection and Installation
- Internal Drainage Systems for Embankment Dams
- Internal Erosion Applying Erosion Mechanics from ICOLD Bulletin 164 in Internal Erosion Failure Mode Analyses
- Intro to Post-Tensioned Anchors for Dams
- Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?
- Introduction to Embankment Dam Remedial Mitigation
- Introduction to Grouting for Dams
- Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
HYDRAULICS
• Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Dam Overtopping Protection Systems - Part 2
• Delhi Dam - A Compound Failure
• Extreme Precipitation and Dam Safety in a Changing Climate
• Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan
• Findings of the Oroville Dam Spillway Forensic Investigation
• Human Factors in the Edenville Dam Failure
• Human Factors in the Oroville Dam Spillway Incident
• Hydrologic Hazards - Estimating Probabilities of Extreme Floods
• Hydrology 101 for Dam Safety
• Hydrology 201 for Dam Safety
• Improving the Dam Safety Design Review Process
• Inlet and Outlet Hydraulics for Spillways and Outlet Structures
• Introduction to Hydrologic Modeling Using Geospatial Information
• Michigan Failures/Pandemic – Impacts to the ASDSO Peer Review Process
• PMP and the History of HMRs
• Rainfall and Dam Safety- From PMP to the 100-Year Storm
• Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
• Stream Management for Dam Construction
• The State of the Practice and Future of Dam Breach Modeling
• Uplift and Drainage for Concrete Dams and Spillways
• WinDAM - Overtopping and Internal Erosion for Earthen Embankments

INSPECTIONS
• Application of Risk Principles within State Dam Safety Programs
• Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Best Management Practices for Waterstop Selection, Installation, and Inspection
• Best Practices for Dam Safety Warning Signs
• Concrete Construction – Issues and Remedies
• Concrete Repair and Maintenance for Dams
• Dam Overtopping Protection Systems - Part I
• Designing Spillways to Mitigate Failure Modes
• Emergency Intervention Toolbox
• Findings of the Oroville Dam Spillway Forensic Investigation
• Fundamentals of Concrete Construction Inspections for Dams and Appurtenant Structures
• Human Factors in the Edenville Dam Failure
• Human Factors in the Oroville Dam Spillway Incident
• Inlet and Outlet Hydraulics for Spillways and Outlet Structures
• Inspection and Assessment of Spillways
• Intro to Post-Tensioned Anchors for Dams
• Introduction to Spillway Gates
• Judgment and Decision-Making in Dam Engineering
• Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Michigan Failures/Pandemic – Impacts to the ASDSO Peer Review Process
• Monitoring of Dams
• Repairs and Maintenance for Dams
• Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
• Rehabilitation of NRCS Watershed Structures - Part I
• Running the Spillway Gate
• Structural Condition Assessment of Dam Facilities with Non-Destructive Evaluation Methods
• Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions
• The Practical Use of Geophysics to Assess Dam and Levee Safety
• WinDAM - Overtopping and Internal Erosion for Earthen Embankments

PROGRAM MANAGEMENT
• Application of Risk Principles within State Dam Safety Programs
• Developing Operations and Maintenance Manuals for Dams
• Emergency Action Plan Basics
• How to Communicate Effectively in Any Situation
• How to Conduct a Successful PFMA - Lessons Learned from Past Successes and Failures
• Human Factors in the Edenville Dam Failure
• Human Factors in the Oroville Dam Spillway Incident
• Identifying Hazards and Improving Public Safety at Low Head Dams
• Improving the Dam Safety Design Review Process
• Intro to Post-Tensioned Anchors for Dams
• Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?
• Introduction to Dam Decommissioning
• Introduction to Public Safety Risk Evaluation and Treatment for Dams and Levees
• Judgment and Decision-Making in Dam Engineering
• Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
• Legal Responsibilities of Dam Owners, Operators, and Regulators
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Natural Resources Conservation Service Dam Design and Dam Safety Resources: Policy, Procedures, and Tools
• Risk Assessment for Levee Projects
• Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
• Teton Dam - The Failure That Changed an Industry
• The History of Dam Safety Governance in the US Including Risk Analysis
• Understanding and Managing Plant & Animal Intrusions in Embankment Dams and Levees Part I
• Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees Part II
• Using Instrumentation for Dam Safety Monitoring
• What Can I Really Expect to Get Out of a Semi-Quantitative Risk Analyses (SQRA)?

PUBLIC SAFETY AT DAMS

• Best Practices for Dam Safety Warning Signs
• Dam Overtopping Protection Systems - Part 2
• Dam Overtopping Protection Systems - Part I
• Designing Spillways to Mitigate Failure Modes
• Drilling Plans and Hazard Evaluations for Dams and Levees
• Drone Technology Integrated into Dam Safety Inspections and Evaluations
• How to Conduct a Successful PFMA - Lessons Learned from Past Successes and Failures
• Human Factors in the Oroville Dam Spillway Incident
• Identifying Hazards and Improving Public Safety at Low Head Dams
• Inlet and Outlet Hydraulics for Spillways and Outlet Structures
• Intro to Post-Tensioned Anchors for Dams
• Introduction to Nature-Like Fishways for Dams
• Introduction to Public Safety Risk Evaluation and Treatment for Dams and Levees
• Introduction to Spillway Gates
• Judgment and Decision-Making in Dam Engineering
• Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
• Low-Level Conduits - What Can Go Wrong, How to Inspect, How to Repair?
• Relearning How to Look at Piezometric Data for Seepage Evaluation
• Responding to Dam Emergencies
• Risk Communication for Dams
• Rock Grouting Principles for New and Remedial Dam Projects
• Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures
• Slope Stability Modeling for Embankment Dams: Planning, Interpreting, and Reporting Results
• Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions
• Teton Dam - The Failure That Changed an Industry
• Use of Remote Sensing in Dam Safety Including Drones
• Use of Underwater Remote Systems in Dam Safety

REHABILITATION AND REMEDIATION

• Best Management Practices for Waterstop Selection, Installation, and Inspection
• Concrete Construction – Issues and Remedies
• Concrete Repair and Maintenance for Dams
• Dam Overtopping Protection Systems - Part 2
• Dam Overtopping Protection Systems - Part I
• Design of Siphon Systems
• Designing Spillways to Mitigate Failure Modes
• Emergency Intervention Toolbox
• Evaluation and Maintenance of Piezometers, Relief Wells, and Drains in Dams and Levees
• Filters and Drainage Systems for Embankment Dams
• Foundation Cutoff Walls for Dams and Levees
• Fundamentals of Concrete Construction Inspections for Dams and Appurtenant Structures
• Guidelines for Assigning Erodibility Parameters to Soil Horizons for SITEs analyses
• Human Factors in the Edenville Dam Failure
• Human Factors in the Oroville Dam Spillway Incident
• Improving the Dam Safety Design Review Process
• Inlet and Outlet Hydraulics for Spillways and Outlet Structures
• Intro to Post-Tensioned Anchors for Dams
• Introduction to Addressing Inadequate Conveyance Capacity at Dams
• Introduction to Armoring Embankment Dams and Earth-Cut Spillways with ACBs
• Introduction to Embankment Dams
• Introduction to Spillway Gates
• Latest Trends in Roller-Compacted Concrete (RCC) Spillways and Overtopping Protection Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Managing Increased Dam Safety Risk During Reconstruction
• Natural Resources Conservation Service Dam Design and Dam Safety Resources: Policy, Procedures, and Tools
• Putting Public Safety First - The Oroville Dam Spillways Emergency Recovery
• Rehabilitation of Concrete Dams
• Rehabilitation of NRCS Watershed Structures - A Consultant's Perspective
• Rock Grouting Principles for New and Remedial Dam Projects
• Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures
• Roller Compacted Concrete - Design and Construction of Water Control Structures
• Seepage Rehabilitation for Embankment Dams
• Sliping Low Level Conduits
• Specialty Construction Techniques for Foundation Improvement and Seepage Reduction
• Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions
• Stepped Chute Spillway Design for Embankment Dams
• Stream Management for Dam Construction
• The 1979 Machhu Dam Disaster: Social Origins and Social Consequences
• Understanding and Managing Plant & Animal Intrusions in Embankment Dams and Levees Part I
• Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees Part II
• Underwater Installation of Geomembranes
• Uplift and Drainage for Concrete Dams and Spillways
• Use of Underwater Remote Systems in Dam Safety
• Waterproofing Systems for Dams
• Why Embankments Crack and How to Fix Them
• WinDAM - Overtopping and Internal Erosion for Earthen Embankments

REMOVAL

• Concrete Repair and Maintenance for Dams
• Introduction to Dam Decommissioning
• Introduction to Nature-Like Fishways for Dams
• Rehabilitation of NRCS Watershed Structures - A Consultant's Perspective

RISK-INFORMED DECISION MAKING

• Application of PFMA in Dam Safety
• Application of Risk Principles within State Dam Safety Programs
• Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Dam Overtopping Protection Systems - Part I
• Designing Spillways to Mitigate Failure Modes
• Event Tree Principles and Applications for Dam Safety Risk Assessment
• Extreme Precipitation and Dam Safety in a Changing Climate
• How to Conduct a Successful PFMA - Lessons Learned from Past Successes and Failures
• Human Factors in Dam Failure and Safety
• Human Factors in the Edenville Dam Failure
• Human Factors in the Oroville Dam Spillway Incident
• Internal Erosion Applying Erosion Mechanics from ICOLD Bulletin 164
• In Internal Erosion Failure Mode Analyses
• Intro to Post-Tensioned Anchors for Dams
• Judgment and Decision-Making in Dam Engineering
• Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Loss of Life Consequence Assessment for Dam Failure Scenarios
• Potential Failure Mode Analysis as a Dam Safety Tool Part I: Introduction to PFMA
• Risk Assessment Basics for an Individual Dam
• Risk Assessment for Levee Projects
• Risk Communication for Dams
• Risk Management for a Portfolio of Dams
• Rock Scout Assessment for Dams, Spillways and other Water Conveyance Structures
• Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
• Stream Management for Dam Construction
• The 1979 Machhu Dam Disaster: Social Origins and Social Consequences
• The History of Dam Safety Governance in the US Including Risk Analysis
• The State of the Practice and Future of Dam Breach Modeling
• Tolerable Risk Guidelines for Dams: How Safe is Safe Enough
• Uplift and Drainage for Concrete Dams and Spillways
• What Can I Really Expect to Get Out of a Semi-Quantitative Risk Analyses (SQRA)?
• WinDAM - Overtopping and Internal Erosion for Earthen Embankment

SECURITY AND PROTECTION
• Judgment and Decision-Making in Dam Engineering
• Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts
• Rock Scout Assessment for Dams, Spillways and other Water Conveyance Structures

SEISMIC ISSUES
• Analysis of Concrete Arch Dams
• Current Trends in the Seismic Analysis of Embankment Dams
• Earthquake Hazards, Ground Motions and Dynamic Response
• Improving the Dam Safety Design Review Process
• Intro to Post-Tensioned Anchors for Dams
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
• Seismic Stability Evaluation of Earth Dams
• Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
• Use of Underwater Remote Systems in Dam Safety

STRUCTURAL ISSUES
• Analysis of Concrete Arch Dams
• Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Best Management Practices for Waterstop Selection, Installation, and Inspection
• Concrete Construction – Issues and Remedies
• Dam Overtopping Protection Systems - Part 2
• Dam Overtopping Protection Systems - Part I
• Dam Safety with 3D Weirs
• Delhi Dam - A Compound Failure
• Designing Spillways to Mitigate Failure Modes
• Drone Technology Integrated into Dam Safety Inspections and Evaluations
• Filter Design History and a One-Step Design Process
• Findings of the Oroville Dam Spillway Forensic Investigation
• Foundation Cutoff Walls for Dams and Levees
• Fundamentals of Concrete Construction Inspections for Dams and Appurtenant Structures
• Human Factors in the Oroville Dam Spillway Incident
• Hydraulic Design of Labyrinth Weirs
• Improving the Dam Safety Design Review Process
• Intro to Post-Tensioned Anchors for Dams
• Introduction to Armoring Embankment Dams and Earth-Cut Spillways with ACBs
• Introduction to Concrete Gravity Dams
• Introduction to Earth Spillway Design and Evaluation
• Introduction to Grouting for Dams
• Introduction to Spillway Gates
• Latest Trends in Roller-Compacted Concrete (RCC) Spillways and Overtopping Protection
• Low-Level Conduits - What Can Go Wrong, How to Inspect, How to Repair?
• RCC Applications in Dam Engineering – What We Have Learned and What’s New
• Reexamination of the 2004 Failure of Big Bay Dam, Mississippi
• Rehabilitation of Concrete Dams
• Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
• Roller Compacted Concrete - Design and Construction of Water Control Structures
• Slippinig Low Level Conduits
• Spillway Conduits - More Than Just a Pipe Through the Dam
• Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions
• Stability Evaluations of Concrete Dams
• Stepped Chute Spillway Design for Embankment Dams
• Structural Condition Assessment of Dam Facilities with Non-Destructive Evaluation Methods
• Terminal Structures and Energy Dissipation at Outlet Works and Spillways
• Uplift and Drainage for Concrete Dams and Spillways
• Use of Remote Sensing in Dam Safety Including Drones
• Use of Underwater Remote Systems in Dam Safety

SURVEILLANCE AND MONITORING
• Automated Instrumentation and Early Warning Systems for the Monitoring of Dams
• Concrete Repair and Maintenance for Dams
• Designing Spillways to Mitigate Failure Modes
• Drone Technology Integrated into Dam Safety Inspections and Evaluations
• Emergency Intervention Toolbox
• Evaluation and Maintenance of Piezometers, Relief Wells, and Drains in Dams and Levees
• How to Conduct a Successful PFMA - Lessons Learned from Past Successes and Failures
• Human Factors in the Oroville Dam Spillway Incident
• Inlet and Outlet Hydraulics for Spillways and Outlet Structures
• Instrumentation in Dams – Selection and Installation
• Intro to Post-Tensioned Anchors for Dams
• Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?
• Low-Level Conduits - What Can Go Wrong, How to Inspect, How to Repair?
• Managing Increased Dam Safety Risk During Reconstruction
• Rehabilitation of NRCS Watershed Structures – A Consultant’s Perspective
• Releasing How to Look at Piezometric Data for Seepage Evaluation
• Rock Scour Assessment for Dams, Spillways, and other Water Conveyance Structures
• Seepage Monitoring and Analysis of Embankment Dams
• Slippinig Low Level Conduits
• Spillway Conduits - More Than Just a Pipe Through the Dam
• Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions
• Stability Evaluations of Concrete Dams
• Stepped Chute Spillway Design for Embankment Dams
• Structural Condition Assessment of Dam Facilities with Non-Destructive Evaluation Methods
• Terminal Structures and Energy Dissipation at Outlet Works and Spillways
• Uplift and Drainage for Concrete Dams and Spillways
• Use of Remote Sensing in Dam Safety Including Drones
• Use of Underwater Remote Systems in Dam Safety

TAILINGS
• Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?
• Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories
• Releasing How to Look at Piezometric Data for Seepage Evaluation
• Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
• Understanding Static Liquefaction

OTHERS
• Analysis of Concrete Arch Dams
• Design of Siphon Systems
• Filters and Drainage Systems for Embankment Dams
• Findings of the Oroville Dam Spillway Forensic Investigation
• Reexamination of the 2004 Failure of Big Bay Dam, Mississippi
• Releasing How to Look at Piezometric Data for Seepage Evaluation
• Risk Communication for Dams
• Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures
• Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment
• Understanding Static Liquefaction
• Why Embankments Crack and How to Fix Them
7. Educational Resources
ASDSO is excited to announce the Dam Safety Toolbox website launch! The Dam Safety Toolbox is a single source for accessing current, state-of-the-practice guidance and resources. The website was developed as a much-needed tool for professionals to gain an understanding of dam safety basics and support knowledge and resource sharing across the dam safety community.

The Dam Safety Toolbox will be maintained by a community of knowledgeable volunteers through open collaboration and a wiki-based editing system. The webpage was launched with key pages developed, but it is just the start! Like other wikis, new interconnected pages can be created, and existing pages can be expanded and edited. Users are encouraged to help build, improve, and maintain the site. Once changes are submitted, a team of volunteer moderators and subject matter experts review and approve the changes as appropriate to maintain the reliability and constancy you expect from an ASDSO product.
READY TO GET STARTED?
HERE ARE A FEW WAYS TO GET INVOLVED:

- **Visit DamToolbox.org**: Start exploring the pages already available on the website. The site is open to the public and intended to facilitate knowledge and tool sharing among professionals.

- **Log in and Submit an Edit**: ASDSO members can log in to suggest edits to existing pages or begin the development of a new page. The website has numerous tools to assist with getting started as a contributor, including formatting and style guides. Members can log in using their existing member portal information.

- **Volunteer as a Moderator**: Those interested in volunteering as a moderator can learn more by submitting some basic information under the 'volunteer' tab on Collaborate.

» Visit DamToolbox.org

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**DamFailures.org**

ASDSO believes there is a pressing need to understand the underlying causes of dam failures to minimize such occurrences in the future. DamFailures.org provides educational information relating to dam failures and incidents in an innovative, user-friendly manner to assist owners and practitioners with critical design and operational decisions.

Presented within DamFailures.org are links to individual case studies and 'lessons learned' pages that summarize historical dam incidents and failures and the valuable information gleaned from them. Each page contains a background and description, photographs, videos, best practices, and other resources related to the case study or lessons learned being addressed. The contents of this website encompass a range of failure modes, dam types, and dam safety topics including best practices regarding engineering and design practices, human factors, emergency planning and response, operation and maintenance, and regulatory issues.

**DamFailures.org now has more than 50 case studies and more than 30 lessons learned from dam failures. Additional content is in development for 2024.**
Resources for Dam Owners & Operators

To make accessing guidance information easier for dam owners and operators, ASDSO has developed numerous educational resources. Resources were also designed to be useful for state dam safety officials and others with owner outreach programs. You can access educational videos, workshops, handouts, guidance documents, and other useful resources on ASDSO’s Dam Owner Outreach webpage.

» Visit DamSafety.org/DamOwners

DAM OWNERSHIP FACT SHEETS

The Dam Ownership Fact Sheet Booklet contains guidance on more than 20 specific issues that dam owners face. All fact sheets are free to download, printer-friendly, and can be used alone or as part of the full booklet.

DAM OWNER ACADEMY VIDEOS

The Dam Owner Academy is a series of videos to educate and inform owners on all aspects of operating and maintaining a dam safely. Each video concisely presents one topic related to safely operating and maintaining a dam. Videos are free, about 10 minutes each, and feature Grady Hillhouse as the host.

Search ASDSO on YouTube for the full Dam Owner Academy Series
ASDSO Collaborate

ASDSO Collaborate is an online networking community for dam safety professionals. The site provides an opportunity to connect with nearly 3,000 professionals across the country through sharing ideas, discussing challenges, posting questions, and searching for ASDSO volunteer opportunities. News from the ASDSO Board of Directors, staff, and committee leaders is also often shared through Collaborate.

Each ASDSO member can create a professional profile and easily search for other members on the site. Members can also start a broad conversation through joining ‘communities’ specific to them and their interests, such as those for committees, regions, key topics, or an ‘all member’ community.

» Visit Collaborate.DamSafety.org
Dam Incident Database

The Dam Safety Incident Database is a searchable, online collection of more than 1000 records of failure and non-failure incidents. Each record has basic information on the dam safety incident such as incident date, type, driver, and mechanism. There is also information on downstream consequences such as evacuations, deaths, damages, etc. as available.

Most of the incident records have been collected from state programs following the year in which they occurred. Some states have been able to provide historic incident information and ASDSO will continue to obtain as much information, both current and historic, as possible. The database is not considered comprehensive of all dam safety incidents, both historic and current, and reflects only the data that ASDSO has been able to collect. Much of the identifying information on specific dams is obtained from the National Inventory of Dams.

» Visit DamSafety.org/Incidents

Dam Safety Resource Database

ASDSO’s Dam Safety Resource Database contains more than 10,000 entries referencing dam safety publications. These entries cover a wide variety of dam safety topics, including technical and non-technical areas, history, best practices, regulations, news, and more. The entries also represent a variety of sources, including federal and state departments, professional societies, research groups, industry news outlets, international organizations, and universities.

All ASDSO conference papers and Journal of Dam Safety articles are included as entries. ASDSO members have free, unlimited access to full ASDSO papers through the resource database.

» Visit DamSafety.org/Resource/Search
Public Awareness

ASDSO has created two booklets to help answer questions about dams including what purposes they serve, what risks are associated with dams and where you can get information about how to react if you are affected by a dam. Digital versions of both booklets are available for free and can be used as a tool in public awareness workshops, trainings and other public outreach efforts.

Print versions of both booklets are available and can be ordered at a fee through the ASDSO office.

» Visit LivingNearDams.org

Public Safety at Dams Resources

Each year, dozens of lives are lost at dams on America’s waterways. People are often unaware of the dangers, or they underestimate their risk of falling victim to them. It may be a case of a simple lack of knowledge, reckless behaviors, lack of warning, or just being in the wrong place at the wrong time. Regardless of the cause or intention, outings on waterways can end in tragedy.

ASDSO provides information and resources that can be used internally or disseminated to the general public to assist in the promotion of safety at dams.

» Visit Damsafety.org/Public-Safety
Journal of Dam Safety

The Journal of Dam Safety is a quarterly members-only publication dedicated to increasing the technical expertise of engineers, owners, operators, and others involved in dam safety. A primary goal is to promote consistency in technical and regulatory approaches to dam safety with examples from various geographic regions, multiple types of dams, and from a variety of perspectives. Articles are selected to share valuable information, lessons learned, and promote new technologies that can benefit the dam safety community. The journal is also a valuable source for industry news, organizational updates, and upcoming events.

ASDSO members may view all past journal articles by browsing our Resource Database!

» Visit DamSafety.org/JDS
State Dam Safety Programs and Topics

By using ASDSO’s state map page, you can easily access state-specific dam safety details, including contact information for ASDSO state representatives, state statutes and regulations, and State Performance Reports.

» Visit DamSafety.org/States
8. My 2024 Training Plan

my training plan
Create your customized 2024 Training Calendar

The following pages will allow you to create your very own 2024 Training Plan. Simply mark the conferences, webinars, and seminars you want to attend, including the On-Demand Webinars needed to round out your training needs. Then, visit DamSafety.org and register for the courses you have selected.
Create your customized 2024 Training Calendar

CONFERENCES

Southeast Regional Conference
Knoxville, TN · April 8-11, 2024

Dam Safety 2024
Denver, CO · September 22-26, 2024

TECHNICAL SEMINARS

Inspection and Assessment of Dams
January 23-25, 2024 · Virtual

Stability Analysis of Embankment Dams
February 6-9, 2024 · Virtual

HEC-RAS
March 5-8, 2024 · Virtual

Improving Emergency Operations for Dam and Levee Failures and Incidents
April 2-4, 2024 · Tampa, FL

HEC-RAS 2D
May 21-23, 2024 · Denver, CO

Seepage Through Earth Dams
June 18-21, 2024 · Virtual

Basic Soil Mechanics Related to Earth Dams
July 16-19, 2024 · Virtual

Dam Construction Inspection
October 15-17, 2024 · CO

Fundamentals of Reinforced Concrete
November 6-8, 2024 · Virtual

WEBINARS

Why People Die During Flood Events and Options for Reducing Future Flood Fatalities
January 9, 2024

Triaxial Lab Testing for Earth Dams
February 13, 2024

Intrusive Activities in Dams and Levees – Are They Worth the Risk of Creating a Flaw?
March 12, 2024

Modeling Tailings Dam Failures with 2-Phase Flow
April 9, 2024
ON-DEMAND WEBINARS

The 1979 Machhu Dam Disaster: Social Origins and Social Consequences
May 14, 2024

3-D Effects on Estimation of Gradients, Seepage Flows and Evaluation of Internal Erosion Potential Failure Modes
June 11, 2024

Facilitating Low-Head Dam Removals and Improving Aquatic Resource Restoration Outcomes
July 9, 2024

Using the Cone Penetrometer Test (CPT) for Evaluation of Dams and Levees
August 13, 2024

Hydraulic Tour of Standard NRCS Inlet Risers
September 10, 2024

Tools for Designing and Assessing Spillways
October 8, 2024

Best Practices in Floodplain Management Associated With Dam Safety Management and Dam Rehabilitation
November 12, 2024

Ice Loads on Dams
December 10, 2024
Cracking and Hydraulic Fracturing in Embankment Dams and Levees

Current Trends in the Seismic Analysis of Embankment Dams

Dam Construction Quality Control – Do’s, Don’ts and Lessons Learned

Dam Overtopping Protection Systems - Part I

Dam Overtopping Protection Systems - Part II

Dam Safety with 3D Weirs

Delhi Dam – A Compound Failure

Design of Siphon Systems

Designing Slope Protection for Dams and Levees

Designing Spillways to Mitigate Failure Modes

Developing Operations and Maintenance Manuals for Dams

Drilling Plans and Hazard Evaluations for Dams and Levees

Drone Technology Integrated into Dam Safety Inspections and Evaluations

Earthquake Hazards, Ground Motions and Dynamic Response

Emergency Action Plan Basics

Empirical Estimates of Permeability for Earth Dam Projects

Evaluation and Maintenance of Piezometers, Relief Wells, and Drains in Dams and Levees

Evaluation of Seepage Related Potential Failure Modes (PFMA’s) in Embankments with Emphasis on Outlet Penetrations

Event Tree Principles and Applications for Dam Safety Risk Assessment

Exploring Dam Breach Parameters: Observed and Modeled

Extreme Precipitation and Dam Safety in a Changing Climate

Field Investigations for New and Existing Dams

Filter Design History and a One-Step Design Process

Filters and Drainage Systems for Embankments Dams

Findings of the Independent Forensic Investigation of the Failures of Edenville and Sanford Dams, Michigan
Findings of the Oroville Dam Spillway Forensic Investigation
Foundation Cutoff Walls for Dams and Levees
Foundation Preparation and Treatment for Dam Construction
Fundamentals of Concrete Construction Inspections for Dams and Appurtenant Structures
Guidelines for Assigning Erodibility Parameters to Soil Horizons for SITES Analyses
HEC-RAS 2D Modeling
How to Communicate Effectively in Any Situation
How to Conduct a Successful PFMA – Lessons Learned from Past Successes and Failures
How to Make Your Emergency Action Plan More Effective
Human Factors in Dam Failure and Safety
Human Factors in the Edenville Dam Failure
Human Factors in the Oroville Dam Spillway Incident
Hydraulic Design of Labyrinth Weirs
Hydraulics 101: Intro to Hydraulics for Dam Safety
Hydraulics 201 for Dam Safety
Hydrologic Hazards – Estimating Probabilities of Extreme Floods
Hydrology 101 for Dam Safety
Hydrology 201 for Dam Safety
Identifying Hazards and Improving Public Safety at Low Head Dams
Improving the Dam Safety Design Review Process
Inlet and Outlet Hydraulics for Spillways and Outlet Structures
Inspection and Assessment of Spillways
Instrumentation in Dams – Selection and Installation
Internal Drainage Systems for Embankment Dams
Internal Erosion – Applying Erosion Mechanics From ICOLD Bulletin 164 In Internal Erosion Failure Mode Analyses
Intro to Cavitation in Chutes and Spillways

Intro to Post-Tensioned Anchors for Dams

Intro to Tailings Dam and Coal Ash Impoundment Design, Construction and Monitoring: What Can Go Wrong and Right?

Introduction to Addressing Inadequate Conveyance Capacity at Dams

Introduction to Armoring Embankment Dams and Earth-Cut Spillways with ACBs

Introduction to Concrete Gravity Dams

Introduction to Dam Decommissioning

Introduction to Earth Spillway Design and Evaluation

Introduction to Embankment Dams

Introduction to Grouting for Dams

Introduction to Hydrologic Modeling Using Geospatial Information

Introduction to Nature-Like Fishways for Dams

Introduction to Physical Modeling of Spillways for Dams

Introduction to Public Safety Risk Evaluation and Treatment for Dams and Levees

Introduction to Spillway Gates

Judgment and Decision-Making in Dam Engineering

Latest Trends in Roller-Compacted Concrete (RCC) Spillways and Overtopping Protection

Lawn Lake Dam: Pre-Failure Comprehensive Dam Safety Evaluation and Post Failure Impacts

Legal Responsibilities of Dam Owners, Operators, and Regulators

Lessons Learned Regarding Seismic Deformation Analyses of Embankment Dams from Re-Evaluation of the Upper and Lower San Fernando Dams Performance Case Histories

Loss of Life Consequence Assessment for Dam Failure Scenarios

Low-Level Conduits – What Can Go Wrong, How to Inspect, How to Repair?

Managing Increased Dam Safety Risk During Reconstruction

Michigan Failures/Pandemic – Impacts to the ASDSO Peer Review Process

Natural Resources Conservation Service Dam Design and Dam Safety Resources: Policy, Procedures, and Tools
Pitfalls in Quality Control Processes for Compacted Earth Fill

PMP and the History of HMRs

Potential Failure Mode Analysis as a Dam Safety Tool Part I: Introduction to PFMA

Putting Public Safety First – The Oroville Dam Spillways Emergency Recovery

Quality Assurance and Field Inspection for Dam Construction Projects

Rainfall and Dam Safety – From PMP to the 100-Year Storm

RCC Applications in Dam Engineering – What We Have Learned and What's New

Reexamination of the 2004 Failure of Big Bay Dam, Mississippi

Rehabilitation of Concrete Dams

Rehabilitation of NRCS Watershed Structures – A Consultant's Perspective

Relearning How to Look at Piezometric Data for Seepage Evaluation

Responding to Dam Emergencies

Review of the 1938 Construction Slide at Fort Peck Dam

Risk Assessment Basics for an Individual Dam

Risk Assessment for Levee Projects

Risk Communication for Dams

Risk Management for a Portfolio of Dams

Rock Grouting Principles for New and Remedial Dam Projects

Rock Scour Assessment for Dams, Spillways and other Water Conveyance Structures

Roller Compacted Concrete – Design and Construction of Water Control Structures

Seepage Monitoring and Analysis of Embankment Dams

Seepage Rehabilitation for Embankment Dams

Seismic Stability Evaluation of Earth Dams

Selection for Static Slope Stability Analysis

Site Investigation and Parameter Development for Seismic Deformation Analyses of Embankment

Sliplining Low-Level Conduits
Slope Stability Modeling for Embankment Dams: Planning, Interpreting, and Reporting Results

Specialty Construction Techniques for Foundation Improvement and Seepage Reduction

Spillway Conduits – More Than Just a Pipe Through the Dam

Spillway Gates and Dewatering Systems - Lessons Learned and Practical Solutions

Stability Evaluations of Concrete Dams

Stepped Chute Spillway Design for Embankment Dams

Stream Management for Dam Construction

Structural Condition Assessment of Dam Facilities with Non-Destructive Evaluation Methods

Terminal Structures and Energy Dissipation at Outlet Works and Spillways

Teton Dam – The Failure That Changed an Industry

The History of Dam Safety Governance in the US Including Risk Analysis

The Practical Use of Geophysics to Assess Dam and Levee Safety

The State of the Practice and Future of Dam Breach Modeling

Tolerable Risk Guidelines for Dams: How Safe is Safe Enough?

Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees

Understanding and Managing Plant and Animal Intrusions in Embankment Dams and Levees – Part II

Understanding Static Liquefaction

Underwater Installation of Geomembranes

Uplift and Drainage for Concrete Dams and Spillways

Use of Remote Sensing in Dam Safety – Including Drones

Use of Underwater Remote Systems in Dam Safety

Using Instrumentation for Dam Safety Monitoring

Waterproofing Systems for Dams

What Can I Really Expect to Get Out of a Semi-Quantitative Risk Analyses (SQRA)?

Why Embankments Crack and How to Fix Them

WinDAM – Overtopping and Internal Erosion for Earthen Embankments
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