

Revised Final Independent External Peer Review Report for the East Branch Dam, Clarion River, Elk County, Pennsylvania: Dam Safety Modification Report

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
Baltimore District

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July 2, 2010



SHORT-TERM ANALYSIS SERVICE (STAS)

on

**Revised Final Independent External Peer Review Report
East Branch Dam, Clarion River, Elk County, Pennsylvania:
Dam Safety Modification Report**

by

**Battelle
505 King Avenue
Columbus, OH 43201**

for

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Scientific Services Program

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INDEPENDENT EXTERNAL PEER REVIEW REPORT
for the**

**East Branch Dam, Clarion River, Elk County, Pennsylvania:
Dam Safety Modification Report**

EXECUTIVE SUMMARY

The East Branch Dam was authorized for construction by the U.S. Army Corps of Engineers (USACE) under the Flood Control Act of December 22, 1944. Construction of the rolled earth embankment dam began in June 1947 when the initial construction contract was awarded. The dam was completed and put into full operation by June 1952.

East Branch Dam nearly failed in 1957 due to internal erosion. The reservoir was drained; a substantial cavity was discovered in the embankment towards the right side of the dam and located directly above the cut-off trench cut into bedrock. Extensive remedial grouting was performed, but, only in the area of the void and immediately surrounding it.

In 2006, East Branch Dam was evaluated under the Screening for Portfolio Risk Assessment process. Because of the 1957 incident and other seepage conditions, East Branch was assigned a Dam Safety Action Classification (DSAC) rating of II, generally indicating that failure could begin during normal operations or be initiated as the consequence of an event. A primary reason for the DSAC II classification was concern over the structural integrity of the 1957 repair near the right abutment.

A subsequent potential failure mode analysis conducted by the United States Bureau of Reclamation (USBR) in January 2008 identified internal erosion at the location of previously detected internal erosion (repaired in 1957) near the right abutment as the most critical of several significant potential failure modes and a primary threat to public safety. Estimated annualized probability of failure and estimated annualized loss of life were found to be above the threshold that, based on USBR criteria, justifies expedited action to reduce risk. Consequently, in February 2008, alternative interim risk reduction measures were implemented on a temporary basis to modestly reduce risk such that a residual risk is below the “justification to take expedited action” threshold, but still above the “justification to take action” level.

The objective of the Dam Safety Modification (DSM) Study is to reduce risk at East Branch Dam below tolerable risk guidelines or as low as reasonably practicable and to provide adequate information to determine what permanent dam modifications are necessary for the USACE to operate East Branch Lake for the foreseeable future.

USACE is conducting an Independent External Peer Review (IEPR) of the East Branch Dam, Elk County Pennsylvania DSM Report (DSM Report). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the DSM Report.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2010), USACE (2007), and OMB (2004). This final report describes the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Three panel members were selected for the IEPR from 15 identified candidates. Based on the technical content of the DSM Report and the overall scope of the project, the final panel members were selected for their technical expertise in the following key areas: plan formulation, geotechnical engineering, economics, and environment/biology. USACE was given the opportunity to review the panel prior to Battelle establishing subcontracts with them.

The IEPR Panel received electronic versions of the DSM Report, along with a charge that solicited comments on the documents to be reviewed. The charge was prepared by Battelle to assist the USACE in the development of the charge questions that was to guide the peer review, according to guidance provided in USACE (2010) and OMB (2004). USACE was given the opportunity to provide comments, revisions, and subsequently approved the final charge questions.

The East Branch Dam Project Delivery Team from USACE briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review. Other than this teleconference, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced more than 90 individual comments in response to the 40 charge questions.

IEPR panel members reviewed the DSM Report individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. Overall, 11 Final Panel Comments were identified and documented. Of these, five were identified as having medium significance, and five had low significance.

Table ES-1 summarizes the Final Panel Comments by level of significance. Detailed information on each comment is contained in Appendix A of this report.

Table ES-1. Overview of 11 Final Comments Identified by the East Branch Dam IEPR Panel

Significance – Medium	
1	There should be additional discussion on defining the vertical and lateral boundaries of the proposed secant pile cut-off wall and the associated construction costs.
2	The potential for windows to form through the cut-off during the installation of the proposed secant piles should be addressed.
3	Information from the appendices on the formation, screening, and selection of alternatives needs to be included in the DSM Report to make it a stand-alone document.
4	The recommended plan discussion should summarize the effects of delaying implementation of the proposed improvements.
5	Risks and precautions that should be considered during construction to address the excavation, and, if necessary, removal of abandoned oil/gas wells needs to be outlined.
Significance – Low	
6	Stakeholder and public input should be documented in the DSM Report and Environmental Assessment.
7	USACE's determination that slope stability of the downstream dam face is not a credible failure mode needs further documentation in the DSM Report.
8	The economic analysis of alternatives should consider losses that may be experienced by businesses disrupted by flood and/or dam failure (e.g., manufacturing plant production, lost time and revenue), as well as the appropriate emergency response measures.
9	The technical quality, completeness, and readability of the April 2010 Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) would be improved with minor revisions, such as incorporating select information from the June 2009 EA.
10	A more detailed discussion of the completeness, effectiveness, efficiency, acceptability, robustness, resiliency, and redundancy of the final array of plans, including the recommended plan, needs to be included to the DSM Report.
11	Minor suggested changes to the document are recommended to improve the readability and understanding of the report.

The Panel agreed that the DSM Report was adequate and acceptable in terms of the planning, economic, engineering, and environmental methods, models, and analyses used. The history and details of past project maintenance, the previous major rehabilitations, and dam safety modifications were presented in a clear and concise manner, including photos and drawings. The report provides a good description of the no action, non-structural and structural plans for the East Branch Dam. The documents (when included with the appendices) form an integrated and consistent product that leads very logically to the recommendation.

The majority of the Panel's comments focused on providing more detail and discussion to clarify issues in several areas. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation Rationale and Environmental Analysis:

The Panel agreed that the project was very well documented in regards to both of these subjects. However, the Panel suggested that key information from the Environmental Assessment and appendices be included in the main body of the DSM Report for a more comprehensive, stand-alone document as requested by ER 1110-2-1156 and ER 1105-2-100.

Economics:

The Panel agreed that the report adequately assesses risk reduction objectives and constraints using the Flood Impact Assessment model, the Consequence Toolbox, and the Dam Safety Risk Analysis Engine. In addition, tolerable risks were analyzed based on the previous models and the Potential Failure Mode issues were well documented. The report outlines and recommends an alternative management plan that is cost effective. However, in some instances, the Panel suggested information on the costs and benefits assumptions be clarified in the DSM Report by summarizing some information contained in the appendices.

Engineering:

The Panel agreed that the report provided a detailed discussion pertaining to the design and construction of the dam and appurtenant features. In general, the project history, data collection, and engineering issues were well documented. However, the Panel would like to see a little more information on the identification and future handling of the secant pile cut-off scheme and its associated costs and risks.

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LIST OF ACRONYMS

ATR	Agency Technical Review
COI	Conflict of Interest
DrChecks	Design Review and Checking System
DSAC	Dam Safety Action Classification
DSM	Dam Safety Modification
EA	Environmental Assessment
EC	Engineering Circular
EIS	Environmental Impact Statement
ER	Engineering Regulation
FDA	Flood Damage Analysis
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
IEPR	Independent External Peer Review
NEPA	National Environmental Policy Act
NTP	Notice to Proceed
OMB	Office of Management and Budget
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation

1. INTRODUCTION

The East Branch Dam was authorized for construction by the U.S. Army Corps of Engineers (USACE) under the Flood Control Act of December 22, 1944. The authorized project purposes of East Branch Dam include reduction of flood stages on the Clarion River, water conservation, water quality, low-flow augmentation, recreation, and fish and wildlife management. Construction of the rolled earth embankment dam began in June 1947 when the initial construction contract was awarded. The dam was completed and put into full operation by June 1952.

East Branch Dam nearly failed in 1957 due to internal erosion. The reservoir was drained, and a substantial cavity was discovered in the embankment towards the right side of the dam and located directly above the cut-off trench cut into bedrock. Extensive remedial grouting was performed, but only in the area of the void and immediately surrounding it. Although emergency repairs apparently stopped the internal erosion process, based on the absence of visible transport of soil at the downstream toe seepage exit, more recent conditions surrounding and beneath the grouted cavity indicate that there is substantial risk that internal erosion could recur at some other location within the embankment. Full remediation of the dam was not performed in response to the 1957 internal erosion emergency; however, the dam has been closely monitored by inspections and instrumentation. Subsequent investigations suggest the possibility of water-filled voids, pockets of unconsolidated material, and seepage paths between the downstream side of the cavity and the downstream toe, and between the upstream side of the cavity and the reservoir.

In 2006, East Branch Dam was evaluated under the Screening for Portfolio Risk Assessment process. Because of the 1957 incident and other seepage conditions, East Branch was assigned a Dam Safety Action Classification (DSAC) rating of II, generally indicating that failure could begin during normal operations or be initiated as the consequence of an event. A primary reason for the DSAC II classification was concern over the structural integrity of the 1957 repair near the right abutment.

A subsequent potential failure mode analysis conducted by the United States Bureau of Reclamation (USBR) in January 2008 identified internal erosion at the location of previously detected internal erosion (repaired in 1957) near the right abutment as the most critical of several significant potential failure modes and a primary threat to public safety. Estimated annualized probability of failure and estimated annualized loss of life were found to be above the threshold that, based on USBR criteria, justifies expedited action to reduce risk. Consequently, in February 2008, alternative interim risk reduction measures were implemented on a temporary basis to modestly reduce risk such that a residual risk is below the “justification to take expedited action” threshold, but still above the “justification to take action” level.

The objective of the Dam Safety Modification (DSM) Study is to reduce risk at East Branch Dam below tolerable risk guidelines or as low as reasonably practicable and to provide adequate information to determine what permanent dam modifications are necessary for the USACE to operate East Branch Lake for the foreseeable future. Since no additional authorization by

Congress is required to address the dam safety issues, the East Branch Dam, Elk County Pennsylvania: Dam Safety Modification Report was prepared in accordance with Draft Engineering Regulation (ER) 1110-2-1156, dated July 16, 2009.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the East Branch Dam, Elk County Pennsylvania: Dam Safety Modification Report (DSM Report) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers Engineer Circular (EC) No. 1165-2-209, *Civil Works Review Policy* (USACE, 2010), USACE CECW-CP memorandum *Peer Review Process* (USACE, 2007), and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels, was engaged to coordinate the IEPR of the East Branch Dam DSM Report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environment/biology, economic, geotechnical engineering, and plan formulation analyses contained in the DSM Report. Detailed information on the Final Panel Comments is provided in Appendix A.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2010) and USACE (2007).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the economic, engineering, and environmental analysis of the project. In particular, the IEPR addresses the technical soundness of the project's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the East Branch Dam DSM Report was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization under section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the methodology followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described in USACE (2010) and in accordance with USACE (2007) and OMB (2004). Supplemental guidance on evaluation for conflicts of interest was obtained from The National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

3.1 Planning and Schedule

After receiving the notice to proceed (NTP), Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 defines the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the NTP date of February 19, 2010. Note that the work items listed in Task 7 occur after the submission of this report. Battelle will enter the 11 Final Panel Comments into USACE’s Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE and the Panel can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle.

Table 1. East Branch Dam IEPR Schedule

TASK	ACTION	DUE DATE
1	Notice to Proceed (NTP)	2/19/2010
	Final Review documents available	4/19/2010
	End of Period of Performance	8/3/2010
	*Battelle submits draft Work Plan	3/19/2010
	USACE provides comments on draft Work Plan	3/26/2010
	Teleconference (if necessary)	3/26/2010
	*Battelle submits final Work Plan	3/31/2010
	USACE approves final Work Plan (including Final Charge)	4/2/2010
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	3/1/2010
	USACE provides comments on COI	3/4/2010
	*Battelle submits list of selected panel members	3/19/2010
	USACE provides comments on selected panel members	3/24/2010
	Battelle completes subcontracts for panel members	4/7/2010
3	*Battelle submits draft charge (combined with Draft Work Plan – Task 1)	3/19/2010
	USACE provides comments on draft charge	3/26/2010
	*Battelle submits final charge (combined with Final Work Plan – Task 1)	3/31/2010
	USACE approves final charge	4/1/2010
4	USACE/Battelle Kick-off Meeting	3/2/2010
	Review documents sent to panel members	4/20/2010
	USACE/Battelle/Panel Kick-off Meeting	4/23/2010

TASK	ACTION	DUE DATE
4	Panel members complete their review	5/7/2010
5	Convene Panel review teleconference	5/18/2010
	Panel members provide draft Final Panel Comments to Battelle	5/26/2010
6	*Battelle submits Final IEPR Report	6/11/2010
	*Battelle submits Revised Final IEPR Report	7/2/2010
7	Battelle inputs Final Panel Comments to DrChecks. Battelle provides Final Panel Comment response template to USACE	6/15/2010
	USACE provides draft Evaluator Responses and clarifying questions to Battelle	6/25/2010
	Teleconference convened between USACE, Battelle, and Panel to discuss Final Panel Comments, draft Evaluator Responses and clarifying questions	6/30/2010
	USACE inputs final Evaluator Responses in DrChecks	7/13/2010
	IEPR Panel responds to USACE Evaluator Responses (BackCheck Responses) and Battelle inputs BackCheck responses in DrChecks	7/27/2010
	*Battelle submits pdf printout of DrChecks project file	7/28/2010
	Project Closeout	10/29/2010

Deliverables are noted with an asterisk (*)

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: geotechnical engineering, economics, environment/biology, and plan formulation. These areas correspond to the technical content of the DSM Report and overall scope of the East Branch Dam study.

To identify candidate panel members, Battelle reviewed experts in Battelle’s Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle initially identified 15 candidates for the Panel, evaluated their technical expertise, and inquired about potential conflicts of interest. Of these, Battelle chose seven of the most qualified candidates and confirmed their interest and availability. Of the seven candidates, three were proposed to cover the four areas of expertise for the final Panel and four were proposed as backup reviewers. The three proposed primary reviewers constituted the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed conflicts of interest, or lack of the precise technical expertise required.

The candidates were screened for the following potential exclusion criteria or conflicts of interest (COI).¹ These COI questions were intended to serve as a means of disclosure, and to better characterize a potential candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the IEPR Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

Potential Exclusion Criteria/Conflicts of Interest

- Involvement by you or your firm² in any part of the East Branch Dam, Elk County, Pennsylvania Dam Safety Modification (DSM) Study, including the Environmental Assessment and Technical Appendices.
- Involvement by you or your firm² in any work related to the East Branch Dam, East Branch Lake, or the Clarion River.
- Involvement by you or your firm² in the conceptual or actual design, construction, or operation and maintenance of projects for the East Branch Dam, East Branch Lake, or the Clarion River.
- Current employment by the USACE.
- Involvement with paid or unpaid expert testimony related to the East Branch Dam, Elk County, Pennsylvania Dam Safety Modification Project.
- Current or previous employment or affiliation with the non-Federal sponsors or any of the following Federal, State, County, local and regional agencies, environmental organizations, and interested groups: Ohio River Basin Water Resources Association, U.S. Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission (PAF&BC), U.S. Environmental Protection Agency (EPA), **and** currently working on East Branch Dam, Elk County, Pennsylvania Dam Safety Modification-related projects (for pay or *pro bono*).
- Past, current or future interests or involvements (financial or otherwise) related to East Branch Dam, East Branch Lake, or the Clarion River.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are *specifically* with the Pittsburgh District.

¹ Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "...when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

² Includes any joint ventures in which your firm is involved.

- Current firm² involvement with other USACE projects, *specifically* those projects/contracts that are with the Pittsburgh District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role.
- Previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm²) within the last 10 years, *notably* if those projects/contracts are with the Pittsburgh District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning dam safety and safety modification studies, and include the client/agency and duration of review (approximate dates).
- Pending, current or future financial interests in East Branch Dam, Elk County, Pennsylvania Dam Safety Modification Project-related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm² revenues within the last three years came from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the East Branch Dam, Elk County, Pennsylvania Dam Safety Modification Project including the East Branch Dam Safety Modification Report and supporting technical appendices.
- Is there any past, present or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe:

In selecting the final members of the Panel from the list of candidates, Battelle chose experts who best fit the expertise areas and had no conflicts of interest. The three final reviewers were either affiliated with academic institutions or consulting companies or were independent engineering consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of conflicts of interest through a signed Conflict of Interest form. USACE was given the opportunity to review the panel prior to Battelle establishing subcontracts with them. Section 4 of this report provides names and biographical information on the panel members.

Prior to beginning their review, all members of the Panel attended a kick-off meeting via teleconference that was planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication, and other pertinent information for the Panel.

3.3 Preparation of the Charge and Conduct of the IEPR

Battelle drafted a preliminary charge document, including specific charge questions and discussion points. The charge was prepared by Battelle to assist the USACE in the development of the charge questions that will guide the peer review, according to guidance provided in USACE (2010) and OMB (2004). The draft charge was submitted to the USACE for evaluation as part of the draft Work Plan. USACE provided comments and revisions to the draft charge, which were used to produce the final charge. The final charge was submitted to USACE for

approval. In addition to a list of 40 charge questions/discussion points, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Battelle planned and facilitated a final kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meeting, the IEPR Panel received an electronic version of the DSM Report and the final charge. A full list of the documents reviewed by the Panel is provided in Appendix B of this report. The Panel was instructed to address the charge questions/discussion points within a comment-response form provided by Battelle.

3.4 Review of Individual Comments

The Panel produced approximately 90 individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle was able to summarize the 90 comments into a preliminary list of 18 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Battelle facilitated a 2.5-hour teleconference with the Panel so that they, many of whom are from diverse scientific backgrounds, could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments and to decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the final IEPR report would accurately represent the Panel's assessment of the project, including any potential conflicting opinions. The Panel engaged in a thorough discussion of the overall negative comments, positive comments, and comments that appeared to be conflicting among panel members. In addition, Battelle confirmed each comment's level of significance to the Panel, added any missing issues of importance to the findings, resolved whether to "agree to disagree" on the conflicting comments, and merged any related individual comments.

The Panel also discussed responses to seven specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel; each comment was either incorporated into a Final Panel Comment or determined to be a non-significant issue (i.e., a true disagreement did not exist).

At the end of these discussions, the Panel identified 11 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared for the Panel a summary memorandum documenting each Final Panel Comment (organized by level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the DSM Report.

- **Lead Responsibility:** For each Final Panel Comment, one panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. To assist each lead in the development of the Final Panel Comments, Battelle distributed merged individual comments in the comment-response form table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and a template for the preparation of the Final Panel Comments.
- **Directive to the Lead:** Each lead was encouraged to communicate directly with other IEPR panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- **Format for Final Comments:** Each Final Panel Comment was presented as part of a four-part structure:
 1. Comment Statement (succinct summary statement of concern)
 2. Basis for Comment (details regarding the concern)
 3. Significance (high, medium, low; see description below)
 4. Recommendation for Resolution (see description below).
- **Criteria for Significance:** The following were used as criteria for assigning a significance level to each Final Panel Comment:
 1. High: Describes a fundamental problem with the project that could affect the recommendation or justification of the project
 2. Medium: Affects the completeness or understanding of the reports/project
 3. Low: Affects the technical quality of the reports but will not affect the recommendation of the project.
- **Guidance for Developing the Recommendation:** The recommendation was to include specific actions that the USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, or areas where additional documentation is needed).

At the end of this process, 11 Final Panel Comments were prepared and assembled. Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel’s overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle’s Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of

primary and backup candidate panel members (which were screened for availability, technical background, and conflicts of interest), provided it to USACE, and Battelle made the final selection of panel members.

An overview of the credentials of the final three members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each panel member and his area of technical expertise is presented in the text that follows the table.

Table 2. East Branch Dam IEPR Panel: Technical Criteria and Areas of Expertise

	Findlay	Rogers	Kelsoe
Geotechnical Engineering	X		
Primary research and/or project work revolves around dam design	X		
Primary research and/or project work revolves around dam safety	X		
Minimum 10 years demonstrated experience in geotechnical studies and design of embankment dams	X		
Experience in the post-construction, evaluation, and rehabilitation of embankment dams	X		
Experience with subsurface seepage	X		
Experience with piping analysis	X		
Experience with remediation of embankment dams	X		
Experience with cut-off wall construction	X		
Experience with grouting	X		
Registered Professional Civil Engineer	X		
Plan Formulation		X	
Minimum of 10 years demonstrated experience in planning and the plan formulation process		X	
Experience in plan formulation for flood risk management projects		X	
Familiar with evaluation of alternative plans for multi-purpose projects, including those with flood risk management and ecosystem restoration benefits, costs, and trade-off analysis		X	
Experience with USACE planning processes		X	
Environment/Biology		X	
Familiar with all National Environmental Policy Act (NEPA) and Environmental Impact Statement (EIS) requirements		X	
Particular knowledge of flood damage impacts on local environments		X	
Minimum of 10 years of experience in the above technical areas		X	

	Findlay	Rogers	Kelsoe
Economics			X
Familiar with HEC Flood Damage Analysis (FDA) computer model			X
Familiar with flood risk management			X

R. Craig Findlay, Ph.D., P.E.

Role: This panel member was chosen primarily for his geotechnical engineering experience and expertise.

Affiliation: Findlay Engineering, Inc.

Dr. Findlay, P.E., earned his Ph.D. in geotechnical engineering from the University of New Hampshire in 1991 and is a licensed professional civil engineer in ten states (Alabama, California, Georgia, Idaho, Maine, Montana, New Hampshire, New York, Vermont, and Washington). He is also a licensed Geotechnical Engineer in California. He has 33 years of experience in dam safety, water resources, and geotechnical engineering and is currently the owner of Findlay Engineering, Inc. Dr. Findlay has worked as the technical lead or lead geotechnical engineer on hundreds of dam-related projects, giving him broad experience in earth dam and embankment design; stability, liquefaction, and deformation analysis; seepage and piping assessments; finite element analysis of stresses in embankment dams; water retaining structure remediation; cement-bentonite cut-off and slurry walls; grouting; anchor design; and dam safety inspections, among other topics. Dr. Findlay has been a Federal Energy Regulatory Commission (FERC)-approved Independent Consultant on more than 250 FERC Part 12 Inspections and has conducted numerous dam structural stability analyses for gravity, embankment, and arch dams. He has presented and/or published technical papers on seismic analysis of dams and rehabilitation, dam seepage, dam remediation, dam stability, reservoir erosion, and *in situ* soil property measurement. Dr. Findlay’s experience in cut-off wall construction on embankment dams includes the Lake Blackshear Dam in Georgia, which was breached in 1994. His subsurface investigations resulted in the construction of a cement-bentonite slurry cut-off wall which remediated the potential seepage damage to the intact portions of the dam and mitigated the potential for future piping through the alluvial sands below the breached section which is summarized in AASDSO and USSD Conference Papers in 1995. Dr. Findlay’s grouting and subsurface seepage background includes several projects on embankment dams, including the sealing of a 36-inch relief well header pipe where sediment transport was occurring, which was summarized in an ASDSO Conference Paper in 2006. Additional experience includes seepage, slope stability analysis and toe drain reconstruction for the Southern California Edison’s Vermilion Dam in southern California. Dr. Findlay modeled the seepage through and within the foundation beneath the dam using the SEEP/W model and used the results to conduct a slope stability analysis. He has extensive experience in piping analysis, including serving as a FERC Part 12 Independent Consultant on the Ashton Dam in Idaho, which is currently in the design phase of rehabilitation for piping, and serving as an expert witness in a dam failure which involved piping. For several years, he has been the annual Independent Consultant to review seepage and piping stability of the Vermilion Dam. He has authored a paper on piping assessment of glacial till-concrete interfaces in the 1993 Waterpower Conference. Dr. Findlay has worked on several embankment dam rehabilitation projects,

including Diversion Dan (New York), Skelton Dam (Maine), Lake Blackshear Dam (Georgia), Graham Lake Dam (Maine), and Abbott Brook Dike (Maine).

Barton Rogers

Role: This panel member was chosen primarily for his plan formulation and environmental/biology experience and expertise.

Affiliation: GEC, Inc.

Mr. Rogers earned an M.S. in forestry, wildlife, and fisheries in 1979 from Louisiana State University. His 11 years of plan formulation experience include 6 years with USACE, New Orleans District, and the last 5 years as a consultant. While he was employed by USACE, Mr. Rogers served as an Environmental Manager for interdisciplinary planning studies and projects and worked with the Hydraulic and Hydrologic Branch to better integrate hydraulic and hydrologic issues into the planning process. He directed multidisciplinary teams that developed planning studies for major watershed-wide water resource multipurpose projects that included ecosystem restoration, navigation, and flood-damage reduction and developed and negotiated Feasibility Cost Sharing Agreements and Project Cooperation Agreements. Mr. Rogers served as Project Manager/Planner for several large multipurpose projects at the New Orleans District, including the Amite River and Bayou Manchac Ecosystem Restoration projects, and the East Baton Rouge and Lafayette Flood Control projects. He has experience managing projects covering all phases of planning and project management including reconnaissance, feasibility, preconstruction, engineering and design, and construction. Mr. Rogers is a trained USACE Planning Associate and was an instructor/course developer for the USACE Core Planner's Curriculum course "Hydrology and Hydraulics Considerations in Planning." Mr. Rogers has completed over 18 training courses through USACE and has successfully prepared numerous planning-related study/project-specific correspondence items, including feasibility reports, reconnaissance reports, post-authorization change reports, project management plans, independent technical reviews, feasibility cost sharing agreements, operations manuals, and project cooperation agreements. He has 33 years of experience in environmental evaluation, wetlands research, and National Environmental Policy Act (NEPA) compliance. During Mr. Rogers' employ with USACE as a biologist in the Environmental Branch (1994-2005), he developed Environmental Assessments, contributed to Environmental Impact Statements, conducted scoping and permitting activities, and ensured that projects complied with federal and state regulations according to NEPA. His time at USACE also included planning and managing of a variety of civil works projects, including ecosystem restoration and flood damage reduction. For example, he was involved with the Amite River and Tributaries project, which investigated the ecosystem restoration and flood damage reduction opportunities in the Bayou Manchac Watershed in Louisiana. He served as the environmental leader in the development of the reconnaissance report for the Donaldsonville to the Gulf of Mexico hurricane protection/flood control project and investigated hurricane protection, flood control, and ecosystem preservation. Through his position at GEC, Mr. Rogers is currently assisting the State of Louisiana in developing a feasibility study for restoration of areas surrounding the Amite River Diversion Canal by restoring water flow to the fresh water habitats.

Darrell Kelsoe

Role: This panel member was chosen primarily for his economics experience and expertise.

Affiliation: Brown & Gay Engineers, Inc.

Mr. Kelsoe has 25 years of experience in economics, financials, and flood damage reduction projects and is currently an Economics Manager for Brown & Gay Engineers, Inc. He has worked extensively with USACE Galveston, Fort Worth, New Orleans, and Sacramento Districts on feasibility and general re-evaluation studies. His technical expertise includes risk-based analysis using the HEC-FDA modeling program, financial analysis, real estate appraisals, land use analysis and social impacts. He has computed inundation, location, and recreation benefits for urban flood damage reduction projects. Recently, Mr. Kelso served as the Lead Economist for the Halls Bayou Flood Risk Management Study for the Harris County Flood Control District and USACE, Galveston. Mr. Kelsoe prepared the inventory for more than 24,000 structures within the 80 square mile watershed, appraised more than 300 structures using Marshall & Swift to validate the County's property data, estimated future conditions using population and structure inventory forecasting, and performed the risk-based analysis using HEC-FDA (which included Monte Carlo simulations). For the Hunting Bayou (Texas) project, Mr. Kelsoe was the Lead Economist for an economic re-evaluation in accordance with the National Economic Development objective for flood risk management studies. He performed a depth-damage analysis based on current Economics Guidance Memorandum 09-04 along with a price level update based on a random sample of over 50 properties and current replacement cost of new less depreciation. This study also estimated future conditions population, socio-economic analysis, and a structure inventory forecasting, all of which was incorporated into the HEC-FDA model. Mr. Kelsoe has extensive knowledge of the USACE planning process relative to the Principles and Guidelines, the USACE Planning Guidance Notebook (ER 1105-2-100), and the federal objective related to water resource projects.

5. SUMMARY OF FINAL PANEL COMMENTS

The Panel agreed that the DSM Report was adequate and acceptable in terms of the planning, economic, engineering, and environmental methods, models, and analyses used. The history and details of past project maintenance, the previous major rehabilitations, and dam safety modifications were presented in a clear and concise manner, including photos and drawings. The report provides a good description of the no action, non-structural and structural plans for the East Branch Dam. The documents (when included with the appendices) form an integrated and consistent product that leads very logically to the recommendation.

The majority of the Panel's comments focused on providing more detail and discussion to clarify issues in several areas. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation Rationale and Environmental Analysis:

The Panel agreed that the project was very well documented in regards to both of these subjects. However, the Panel suggested that key information from the Environmental Assessment and

appendices be included in the main body of the DSM Report for a more comprehensive, stand-alone document as requested by ER 1110-2-1156 and ER 1105-2-100.

Economics:

The Panel agreed that the report adequately assesses risk reduction objectives and constraints using the Flood Impact Assessment model, the Consequence Toolbox, and the Dam Safety Risk Analysis Engine. In addition, tolerable risks were analyzed based on the previous models and the Potential Failure Mode issues were well documented. The report outlines and recommends an alternative management plan that is cost effective. However, in some instances, the Panel suggested information on the costs and benefits assumptions be clarified in the DSM Report by summarizing some information contained in the appendices.

Engineering:

The Panel agreed that the report provided a detailed discussion pertaining to the design and construction of the dam and appurtenant features. In general, the project history, data collection, and engineering issues were well documented. However, the Panel would like to see a little more information on the identification and future handling of the secant pile cut-off scheme and its associated costs and risks.

Table 3. Overview of 11 Final Panel Comments Identified by East Branch Dam IEPR Panel

Significance – Medium	
1	There should be additional discussion on defining the vertical and lateral boundaries of the proposed secant pile cut-off wall and the associated construction costs.
2	The potential for windows to form through the cut-off during the installation of the proposed secant piles should be addressed.
3	Information from the appendices on the formation, screening, and selection of alternatives needs to be included in the DSM Report to make it a stand-alone document.
4	The recommended plan discussion should summarize the effects of delaying implementation of the proposed improvements.
5	Risks and precautions that should be considered during construction to address the excavation, and, if necessary, removal of abandoned oil/gas wells needs to be outlined.
Significance – Low	
6	Stakeholder and public input should be documented in the DSM Report and Environmental Assessment.
7	USACE's determination that slope stability of the downstream dam face is not a credible failure mode needs further documentation in the DSM Report.
8	The economic analysis of alternatives should consider losses that may be experienced by businesses disrupted by flood and/or dam failure (e.g., manufacturing plant production, lost time and revenue), as well as the appropriate emergency response measures.
9	The technical quality, completeness, and readability of the April 2010 Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) would be improved with minor revisions, such as incorporating select information from the June 2009 EA.

10	A more detailed discussion of the completeness, effectiveness, efficiency, acceptability, robustness, resiliency, and redundancy of the final array of plans, including the recommended plan, needs to be included to the DSM Report.
11	Minor suggested changes to the document are recommended to improve the readability and understanding of the report.

6. REFERENCES

OMB (2004). Final Information Quality Bulletin for Peer Review. Executive Office of the President, Office of Management and Budget, Washington, DC. Memorandum M-05-03. December 16.

The National Academies (2003). Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports. The National Academies (National Academy of Science, National Academy of Engineering, Institute of Medicine, National Research Council). May 12.

USACE (2000). Planning: Planning Guidance Notebook. Department of the Army, US Army Corps of Engineers, Washington, DC. CECW-CP Engineering Regulation 1105-2-100. April 22.

USACE (2007). Peer Review Process. Department of the Army, US Army Corps of Engineers, Washington, DC. CECW-CP Memorandum. March 30.

USACE (2009). Draft Chapter 9 Dam Safety Modification Studies and Documentation. Engineering Regulation No. 1110-2-1156. July 16.

USACE (2010). Water Resources Policies and Authorities: Civil Works Review Policy. Department of the Army, US Army Corps of Engineers, Washington, DC. Engineer Circular (EC) No. 1165-2-209. January 31.

APPENDIX A

Final Panel Comments

on the

East Branch Dam Safety Modification Report

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Final Panel Comment 1:

There should be additional discussion on defining the vertical and lateral boundaries of the proposed secant pile cut-off wall and the associated construction costs.

Basis for Comment:

In the Panel's April 23, 2010 kickoff conference call with the U.S. Army Corps of Engineers (USACE), it was indicated that additional testing and grouting would be necessary prior to construction of the proposed improvements. This additional work was noted briefly in the East Branch Dam, Clarion River, Elk County, Pennsylvania, Dam Safety Modification Report, Preliminary Draft, March 2010 (DSM Report); however, a more detailed discussion should be provided to understand the level of effort anticipated to "identify the point at which the rock is relatively impermeable, such that the likelihood of internal erosion is minimized," as is stated on page 91.

The Panel believes that conceptual/preliminary acceptance criteria should be developed to demonstrate how the decision will be made to determine the cut-off wall depth or lateral extent (in the context of what is known about the geology of the site [e.g., the apparent abundance of open joints and high associated permeability]). The Panel recommends that the DSM Report include a detailed discussion of the secant pile installation including potential adjustments to the proposed pile depth and alignment to achieve a successful cut-off formation. The DSM Report implies that the proposed cut-off wall will extend up to 300 feet deep, based on a bottom elevation of 1,400 feet, and acknowledges that "the exact depth will be determined during the design phase, probably concurrently with an early phase drilling contract which should be exploratory in nature" (page 92). To the Panel's knowledge, the proposed secant wall may be the deepest installed in an embankment dam in the United States; the referenced Wolf Creek Dam project had a secant wall depth of 275 feet.

Sufficient data are not available to define the boundaries of the proposed secant pile cut-off (e.g., lateral ends and bottom of the cut-off wall). Although some information was provided in the DSM Report with regard to defining the bottom of the cut-off – such as information on page 97, which indicated the cut-off bottom was to be at elevation 1,400 feet based on "conservative interpretation" of Lugeon testing – it did not discuss any underlying analyses/evaluation or criteria to make that determination. Some Lugeon testing results are plotted on Figure 2.29 (page 37) to a bottom elevation of 1,400 feet, and these results indicate Lugeon values of up to 45 below elevation 1,450 feet (generally up to 1,000 above this elevation), but this only encompasses the right abutment (three borings) and Station 12+50 (one boring). Only two of the four borings reported on this plot actually extended deep enough to show a significant decrease in Lugeon values compared to the upper portions of the borings.

The basis for and confidence in preliminary selection of the point where the cut-off bottom begins to slope upward toward the left abutment is not discussed. No plots of Lugeon testing results similar to Figure 2.29 for the left half of the dam were provided.

Discussion of the initial construction testing, acceptance criteria, and grouting extent at the lateral ends of the cut-off was not sufficient. This is important to understand the potential effort and cost, which may be significant.

Significance – Medium:

Additional information for the vertical and lateral boundaries is needed to better understand the level of risk and cost impacts.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A discussion (possibly in Section 3.3.2.2) of the risks and level of effort anticipated in initial construction testing and grouting, in the context of the site geology. Cite case histories to support this discussion.
2. A discussion (possibly in Section 3.3.2.2) on the preliminary acceptance criteria for determining where the bottom and lateral limits of the cut-off will be, and the confidence to assume the current limits envisioned (Figure 3.15) are a reasonable first assumption in the context of what is known regarding the site geology.
3. A discussion in the cost-estimating portion of the document regarding the confidence that the costing contingencies assumed are reasonable with regard to the level of risk involved in defining the lateral and vertical limits of the cut-off.
4. A revised Figure 3.15 on page 93 indicating the left end of the cut-off extends through the spillway as noted by USACE on the kickoff call.

Final Panel Comment 2:

The potential for windows to form through the cut-off during the installation of the proposed secant piles should be addressed.

Basis for Comment:

It is the Panel's opinion that a slight deviation in the verticality of individual piles could result in an unsealed opening through the cut-off (i.e., a window) at depth (generally toward the bottom of the cut-off). Therefore, this remediation scheme may be outside of the experience boundaries of the technique, particularly if a deeper than anticipated cut-off is required, and could have some associated risk. The DSM Report should include a discussion of the means of evaluating the overlap (or lack thereof) of the piles to determine if there are windows. In addition, if windows are suspected, feasible remedial approaches and associated construction costs should be discussed.

While reviewing other projects, the Panel found that there were some verticality difficulties at Wolf Creek Dam, a similar project to East Branch Dam. These problems were remedied by drilling additional secant piles on both sides of the areas of concern to bolster the cut-off thickness. Some discussion of this is needed in the DSM report (e.g., how lessons learned from Wolf Creek Dam will bear on this project). There is some discussion in the emails included in Appendix K, but the information should be brought forward to the DSM Report and discussed in the engineering evaluation as a feasibility issue.

During the kickoff conference call with the USACE on April 23, 2010, there was a discussion of using pilot holes to help maintain verticality; however, it is the Panel's opinion that there could be some issues with their verticality toward the bottom of the proposed cut-off depth as well. If the hole were laterally off by 0.007 feet per foot of hole, this could result in a 2-foot horizontal offset, potentially resulting in a window at a depth of 300 feet. Depending on the difficulty with this issue, this could add to the challenge, effort, and cost of the repair of East Branch Dam.

Significance – Medium:

Additional information is required in the DSM Report in order to fully address the design and construction process for the secant wall installation.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A discussion of the potential for windows and associated seepage through the cut-off due to verticality problems, and how to reduce this potential problem during construction. The Panel recommends using the Wolf Creek Dam case, or others, to support this discussion.
2. A discussion on how the presence of windows will be evaluated and what remedial efforts will be required if a window is suspected to exist.
3. A discussion regarding the confidence of the cost estimating contingencies with regard to increased level of effort/cost of treating windows. The Panel recommends citing related costs involved with Wolf Creek Dam.

Final Panel Comment 3:

Information from the appendices on the formation, screening, and selection of alternatives needs to be included in the DSM Report to make it a stand-alone document.

Basis for Comment:

The plan formulation as presented has all the correct components. However, the DSM Report would be improved with the addition of details found only in the appendices. The addition of this information would demonstrate consistency with the U.S. Army Corps of Engineers Guidance, specifically ER 1110-2-1156 (Dam Safety Modification Studies and Documentation) and ER 1105-2-100 (Planning Guidance Notebook). For example, ER 1105-2-100 states that the planning steps should begin by defining management measures [Section 2-3 (c)], and these measures should serve as building blocks for alternatives. It is the Panel's opinion that this process was followed, but the main document could be improved with the addition of details found in the appendices to demonstrate that the process defined in ER 1105-2-100 was followed.

Significance – Medium:

The lack of information in the DSM Report affects the understanding of how the recommended plan was selected, including that all reasonable measures and alternatives were considered and that a sound evaluation process was followed.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. Add a discussion clarifying whether all measures reviewed for this project are presented in Table 3.6. If other measures were reviewed but eliminated for various reasons, then they should be presented and the reasons for screening them out should be presented.
2. Include text to reflect that once the measures were screened, they were then formulated into an interim (or initial) array of alternatives; this would be NS1-NS3 and S1-S6. Next, discuss the screening/evaluation of this initial array of alternatives to get to the final array (S3-S6). The Panel recommends an introductory statement on this process. Discuss the detailed information on how alternatives NS1-3/S1/S2 were screened in the planning process. The Panel recommends a table that shows the initial array of alternatives (NS1-NS3, S1-S6) with the reason(s) some alternative were eliminated before the final analysis. Finally, show how the final array was evaluated with the final analysis.
3. Add a table to show how the six required alternatives in ER 1110-2-1156 are met by the initial array.
4. Provide a section summarizing the costs (light to moderate level of detail) for each alternative, and reference the Cost Appendix. This level of detail should give the decision maker sufficient data to see the "bottom line" and the cost/benefits breakdown as well.
5. For Alternative S6, as the \$52M is for the implementation costs only, add a column on Table 3.7 that would show the flood damage reduction benefits of the dam as well. The point is that the cost to the public for the implementation of Alternative S6 is not \$52M; the \$52M total includes both the dam removal plus the flood damage losses associated with the loss of the dam. Note there also would be loss of benefits and costs associated with the natural resource impacts, such as recreation losses, water quality issues with the

National Pollutant Discharge Elimination System permit holders, and the acid mine drainage issue.

6. Show all alternatives on Figure 3.28.
7. Provide pictures from the initial kickoff call presentation to the report to more clearly depict the alternatives. Even though these are cartoon-like, they do seem to get the main points across.
8. Include a map (or modify an existing map) that would show the lake and the boundaries of Elk State Park in relation to the project area.
9. Add a map that defines the study area.
10. Add an inset to the map in the Executive Summary that would show the immediate proximity of the downstream communities, such as from Page 31 of the April 23, 2010 presentation from the kickoff call. This would show how a dam break would severely impact these communities.
11. Incorporate Table 26 in Appendix C (page 30) into the screening and evaluation description to justify S3-S5.
12. Provide data on the risks and uncertainties of benefits, costs, and impacts. Provide a narrative on how the average annual benefit of \$18.9 million in Table 3, was calculated.

Final Panel Comment 4:
The recommended plan discussion should summarize the effects of delaying implementation of the proposed improvements.
Basis for Comment:
ER 1110-2-1156 Appendix P, Section 4.6 requires the DSM Report to answer the following questions: <ul style="list-style-type: none"> • “What would be the effect of delaying implementation of the recommended plan?” • “What are the consequences of not implementing or delaying implementation of the recommended ... plan?” <p>However, the DSM Report does not discuss either of these concerns. The effects of delaying the implementation of the recommended plan could cause severe consequences in the form of economic damages to structures and their contents, loss of life, and environmental impacts.</p>
Significance – Medium:
The addition of this information is necessary for the DSM Report to be fully compliant with the requirements outlined in ER 1110-2-1156 Appendix P.
Recommendations for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: <ol style="list-style-type: none"> 1. A discussion of the effects of delaying implementation of the recommended risk management plan. 2. A discussion of the consequences of not implementing or delaying implementation of the recommended plan.

Final Panel Comment 5:

Risks and precautions that should be considered during construction to address the excavation, and, if necessary, removal of abandoned oil/gas wells needs to be outlined.

Basis for Comment:

During review of the East Branch Dam, East Branch Clarion River, Elk County, Pennsylvania: Draft Environmental Assessment, the Panel read that there are potentially a number of abandoned oil and gas wells in the foundation and left abutment of the dam. Installation of the secant piles will require cutting into bedrock approximately 100 feet or more (more at the abutments). As such, there is a potential for the drilled shafts to cut into one or more of these abandoned wells. There should be some discussion in the DSM Report of the potential impacts of such an encounter, including how the oil and gas wells drilled prior to building the dam were typically plugged (deep or surficial plugs and with what), and if there is a potential for the shafts to extend below the plugged interval. Encountering old steel well casings could present an issue with regard to the cutting head. While the hydraulic head of fluid in the drilled shaft may well balance significant release of oil, there is a potential for gas release. The mitigation for the possible explosion hazard was not discussed. In addition, if the plug of an oil well is fully penetrated, there could be negative impacts to the environment and cut-off wall material integrity if oil mixes into the drilling fluid and backfill.

Significance – Medium:

The details of the additional construction effort and costs associated with removing abandoned oil/gas wells have not been applied to the alternative analysis.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A discussion of the potential for encountering abandoned gas and oil wells during advancement of the drilled shafts for the secant pile cut-off 100 feet, or more, into bedrock.
2. A discussion on the potential hazard of encountering an abandoned gas or oil well, and what impacts to drill ability, safety, cut-off wall material integrity, and environment might be possible. Possible additional levels of effort to mitigate these concerns should be presented and discussed.
3. A discussion in the cost estimating portion of the document regarding the confidence of the contingencies with regard to increased level of effort and cost of encountering abandoned wells during drilling of the secant pile holes.

Final Panel Comment 6:
Stakeholder and public input should be documented in the DSM Report and Environmental Assessment.
Basis for Comment:
<p>ER 1110-2-1156 Appendix P, Section 4.6 requires the report to answer the following questions:</p> <ol style="list-style-type: none"> 1. “Is there consensus on the recommended plan by stakeholders and other interested parties and who are they?” 2. “Are there opposing views and what are they and how were the differences addressed?” <p>ER 1105-2-100, Appendix B – Public Involvement and Coordination, Section B-5(2)(2) states, “Feasibility Reports shall include a description and evaluation of the efforts made to acquire public input and the information and opinions expressed prior to arriving at a decision. The public involvement section of the report shall show how public input was used in the planning and decision-making process.” Stakeholder and public input is a critical element for Civil Work projects. The report mentions communication with stakeholders and the public to develop a Communications Plan, but does not mention the views of the stakeholders or other interested parties. Therefore, the views/concerns of the stakeholders have not been presented in the DSM report and Environmental Assessment.</p>
Significance – Low:
The stakeholder/public comments are important to documenting the public coordination for this project.
Recommendations for Resolution:
<p>To resolve these concerns, the Panel recommends the report be expanded to include the following:</p> <ol style="list-style-type: none"> 1. Information on the meetings and other activities conducted to keep the public informed regarding the project, as well as any training information provided to local authorities and stakeholder. 2. A summary of all stakeholder/public comments on this project and its features.

Final Panel Comment 7:

USACE’s determination that slope stability of the downstream dam face is not a credible failure mode needs further documentation in the DSM Report.

Basis for Comment:

Section 3.6.3 (page 116) of the DSM Report, Item 1, indicates “The downstream face of the dam does not meet Corps requirements for static slope stability.” However, this deficiency did not seem to be treated as a credible failure mode in the evaluation of the proposed remedial measures. In the Panel’s kickoff conference call with the U.S. Army Corps of Engineers (USACE) on April 23, 2010, it was indicated that the deviation of slope stability from the recommended minimum factors of safety were small, and considered inconsequential. Slope stability is discussed in more detail in Section 2.3 of Appendix K and provides additional information; however, it is recommended that a summary of why stability of the downstream slope was not considered a credible failure mode be provided in the main DSM report to make it a standalone document. This should include computed stability as well as the Corps minimum recommended values.

Significance – Low:

The technical quality of the report would be improved by describing the non-conformance to USACE failure mode criteria.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A statement to address the slope stability dam safety deficiency that was flagged in the report documenting the analysis and findings. Specifically, the discussion should include the computed and USACE Guidance factors of safety and why the lower than recommended factor of safety for the downstream slope was not considered a significant issue.

Final Panel Comment 8:
The economic analysis of alternatives should consider losses that may be experienced by businesses disrupted by flood and/or dam failure (e.g., manufacturing plant production, lost time and revenue), as well as the appropriate emergency response measures.
Basis for Comment:
<p>There may be additional benefits of implementing the recommended plan that could be qualitatively discussed to demonstrate additional support. The focus of this project is safety and preventing lives lost, as per USACE guidance, such as ER 1110-2-1156 and EC 1105-2-410. The economic analysis for a dam-break scenario also considers the structural damage to businesses and residences would occur if there was some form of dam failure as described in the DSM. However, there also would be additional economic losses associated with the business, job, and production losses that would occur in case of a dam failure – essentially damage to the economic engine. Additionally, there would be costs associated with disaster recovery.</p> <p>A qualitative discussion about these additional losses would provide further support for and better explain overall benefits of the recommended plan.</p>
Significance – Low:
Discussion of these additional losses (qualitative) would add to the understanding of the total benefits of the recommended plan.
Recommendations for Resolution:
<p>To resolve these concerns, the report and Environmental Assessment would need to be expanded to include the following:</p> <ol style="list-style-type: none"> 1. A section to qualitatively discuss the “benefits” of the recommended plan associated with the avoidance of costs from disaster response, and loss or damage to the economic engine in these communities for months, years, or in some cases, perhaps permanently.

Final Panel Comment 9:
The technical quality, completeness, and readability of the April 2010 Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) would be improved with minor revisions, such as incorporating select information from the June 2009 EA.
Basis for Comment:
The environmental methods and analyses are adequate and acceptable. However, the Panel suggests several items to make the EA and FONSI a little more complete in some areas.
Significance – Low:
These recommendations would improve the technical quality and readability of the EA/FONSI.
Recommendations for Resolution:
To resolve these concerns, the April 2010 EA/FONSI would need to be expanded to include the following: <ol style="list-style-type: none"> 1. A dedicated “future without project” section. 2. Tables 6A-B, 7, 8, 9, 10, and the Figures on page 50 from the June 2009 EA. 3. A discussion in the FONSI of the expected continued work regarding the Hazardous, Toxic, and Radioactive Waste (HTRW), as well as a discussion that this issue will be adequately addressed in the design and construction phase. 4. A discussion in the FONSI that there was an interim array of nine alternatives that were screened down to five in the final array for full and final analysis. 5. A paragraph describing the recommended plan in the FONSI.

Final Panel Comment 10:

A more detailed discussion of the completeness, effectiveness, efficiency, acceptability, robustness, resiliency, and redundancy of the final array of plans, including the recommended plan, needs to be included to the DSM Report.

Basis for Comment:

The completeness, effectiveness, efficiency, and acceptability of the recommended plan should be discussed within the DSM Report (Sections 3.4-3.6) to demonstrate how the plan meets these requirements as stated in ER 1105-2-100 Section 2-3(d)(2). Currently, the only reference to meeting these criteria are short answers within cells in Table 3.9. It is the Panel's opinion that the report does not contain an adequate discussion of alternatives for any of these four criteria. For instance, it is not clear how Alternative S6 would be acceptable from any point of view.

The Panel also recommends more detailed discussion on how these plans meet the Robustness, Redundancy, and Resilience criteria. The DSM report mentions in Section 3.3.1, 4th paragraph that "Robustness, Resiliency, and Redundancy, in terms of dam safety, are also considered in the criterion." Also, EC 1105-2-410, Appendix D, Section 1 (c)(3)(d) states the following:

- (3) Factors to consider for a safety assurance review:
- (a) Where the failure of the project would pose a significant threat to human life;
 - (b) Cases where information is based on novel methods, presents complex challenges for interpretations, contains precedent-setting methods or models, or presents conclusions that are likely to change prevailing practices;
 - (c) The project involves the use of innovative materials or techniques;
 - (d) The project design lacks redundancy, resiliency, or robustness:
 - Redundancy. The use of multiple lines of defense that are linked to potential failure modes. The most vulnerable failure modes need the greatest redundancy.
 - Resilience. The use of enhancements to improve the ability of the system to sustain loads greater than the design load to achieve gradual failure modes over some duration rather than sudden failure modes.
 - Robustness. The use of more conservative assumptions to increase capacity to compensate for greater degrees of uncertainty and risk.

However, it appears that robustness, resilience, and redundancy are only addressed in a check-off box in Table 3.9 and that the only evaluation is a rating (partial, yes, NA) for all three combined. A more detailed discussion is needed on how each of the alternatives of the final array addresses the robustness, redundancy, and resilience criteria. For example, the recommended plan is robust in that it strongly addresses all Potential Failure Mode, and there is redundancy in that there are still non-structural measures that would be kept in place as long as they are needed (downstream evacuation plans, alerts, daily inspections, etc.).

Significance – Low:

A discussion of how each of the final array of alternatives meets these seven criteria is important for Civil Works projects as outlined in ER 1105-2-100 and EC 1105-2-410.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A section on how each of the final array of alternatives meets the completeness, effectiveness, efficiency, acceptability, robustness, resiliency, and redundancy criteria, including the recommended plan. An expanded table that would have a discussion (one or two sentence(s) or detailed bullets) for each cell may be an excellent way to present this information.

Final Panel Comment 11:

Minor suggested changes to the document are recommended to improve the readability and understanding of the report.

Basis for Comment:

Minor suggestions for improvement of the report are noted below that it will improve the compliance with ER 1105-2-100.

1. Figure 3.1 does not appear to be cited.
2. The flow direction seems to reverse in figures 3.2-3; recommend keeping the orientation the same.
3. Section 3.1.1.3, third paragraph 4/5 sentences down, the second “s” is missing in “los of life”
4. Page 75, last paragraph, topic sentence indicates devastating flooding and destruction of natural resources, but the rest of the paragraph is more about impacts to man-made structures. Suggest rewording the topic sentence to match the rest of the paragraph and then providing another paragraph to summarize the impacts to the natural resources, (river, fish, wildlife, etc.).
5. Section 3.1.1.3, last paragraph on page 77. The monetary benefits that would be lost under the reconstruction of the dam is listed, suggest adding some text to discuss the natural resource benefits that would be lost as well.
6. Figure 3.12 – The legend shows seven items, but only two are shown on the graph.
7. Section 3.3.3.1 – May want to at least list the Interim Risk Reduction Measures once to clearly show that these non-structural measures are already in place, essentially the list in Section 2.7.4. This is a little redundant, but should be the full description of each alternative in the initial array.
8. Why not have a goal of a DSAC V, not just a DSAC IV? The Panel realizes that a DSAC IV would be acceptable, but suggest a goal of a DSAC V rating, or explain why not.
9. Last sentence of Section 3.3.3.2.4, last sentence, the panel believes that the “S3” should be “S4”.
10. In Section 3.3.3.2, suggest explicitly refer to figures (such as figures 3.24 and 3.25) as opposed to just figures shown below.
11. General, some graphics have a lot of detail and are a little hard to read when presented so small, suggest consider making some full page size, maybe the contrast could be increased, or maybe use graphics from the kickoff call presentation.
12. Section 3.3.3.2.5 - This section seems to have some evaluation text in addition to just describing the alternatives. Seems like this screening language could be added to the screening text presented earlier in the report.
13. The ER1110-2-1156 Appendix P specifically states that a section on Current Use and the Projected Future Use be included. Although this information is presented, there is not a section that is titled this specifically. Recommend this information be gathered and put in a dedicated section.
14. ER 1110-2-1156 requires a dam break analysis and inundation maps. The inundation

maps would be useful in the main report to indicate the consequences of dam failure or the consequences of removing the dam.

15. Section 3.3.3.1.1 of the Dam Safety Modification Study incorrectly references Section 2.7.4 as “Section 2.6.4”.

16. With regard to seismic stability, although not explicitly discussed in the DSM Report, the site seismicity is very low (PGA of about 0.06g for a 2,475 year return period according to the 2002 USGS Hazard Mapping data). Since seismicity is so low at the dam site, it can be judged that the chance of liquefaction or deformation is very low, and therefore dynamic loading failure modes are considered adequately addressed in the Panel’s opinion; however, some further discussion in the DSM Report will circumvent future questions by other reviewers.

Significance – Low:

These minor suggestions would improve the understanding and readability of the report.

Recommendations for Resolution:

To resolve these concerns, the changes suggested above, under the Basis for Comment, would need to be addressed.

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APPENDIX B

Final Charge to the Independent External Peer Review Panel

on the

East Branch Dam Safety Modification Study

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East Branch Dam Safety Modification Study IEPR Final Charge Guidance and Questions to the Panel Members

BACKGROUND

The East Branch Dam was authorized for construction by the U.S. Army Corps of Engineers (USACE) under the Flood Control Act of December 22, 1944. The authorized project purposes of East Branch Dam include reduction of flood stages on the Clarion River, water conservation, water quality, low-flow augmentation, recreation, and fish and wildlife management. Construction of the rolled earth embankment dam began in June 1947 when the initial construction contract was awarded. The dam was completed and put into full operation by June 1952.

East Branch Dam nearly failed in 1957 due to internal erosion. The reservoir was drained, a substantial cavity was discovered in the embankment towards the right side of the dam and located directly above the cut off trench cut into bedrock. Extensive remedial grouting was performed, however, only in the area of the void and immediately surrounding it. Although emergency repairs apparently stopped the internal erosion process, based on the absence of visible transport of soil at the downstream toe seepage exit, more recent conditions surrounding and beneath the grouted cavity indicate that there is substantial risk that internal erosion could recur at some other location within the embankment. Full remediation of the dam was not performed in response to the 1957 internal erosion emergency; however, the dam has been closely monitored by inspections and instrumentation. Subsequent investigations suggest the possibility of water-filled voids, pockets of unconsolidated material, and seepage paths between the downstream side of the cavity and the downstream toe, and between the upstream side of the cavity and the reservoir.

In 2006, East Branch Dam was evaluated under the Screening for Portfolio Risk Assessment process. Because of the 1957 incident and other seepage conditions, East Branch was assigned a Dam Safety Action Classification (DSAC) rating of II, generally indicating that failure could begin during normal operations or be initiated as the consequence of an event. A primary reason for the DSAC II classification was concern over the structural integrity of the 1957 repair near the right abutment.

A subsequent potential failure mode analysis (PFMA) conducted by the United States Bureau of Reclamation (USBR) in January 2008 identified internal erosion at the location of previously detected internal erosion (repaired in 1957) near the right abutment as the most critical of several significant potential failure modes and a primary threat to public safety. Estimated annualized probability of failure and estimated annualized loss of life were found to be above the threshold that, based on USBR criteria, justifies expedited action to reduce risk. Consequently, in February 2008, alternative interim risk reduction measures (IRRM) were implemented on a temporary basis to modestly reduce risk such that a residual risk is below the “justification to take expedited action” threshold but still above the “justification to take action” level.

The objective of the Dam Safety Modification (DSM) Study is to reduce risk at East Branch Dam below tolerable risk guidelines or as low as reasonably practicable and to provide adequate information to determine what permanent dam modifications are necessary for the USACE to operate East Branch Lake for the foreseeable future. Structural and non-structural risk reduction measures have been identified and used to formulate and evaluate a broad array of alternatives for varying degrees of permanent risk reduction; and to ultimately recommend a cost effective, technically feasible alternative that minimizes adverse environmental, economic, and social effects, which could allow the project to operate for the foreseeable future as originally authorized within tolerable risk guidelines. Primary evaluation factors include annual probability of failure, life safety tolerable risk guidelines, As Low As Reasonably Practicable considerations, and essential USACE guidelines. From Chapter 9 of ER 1110-2-1156, the DSM report for DSAC I and DSAC II is required “to identify and recommend an alternative risk management plan that addresses all failure modes that contribute to the DSAC I or II classification such that the failure modes being addressed would be completely remediated and the dam would be reclassified after implementation of the plan.” This study will incorporate, where available, USACE methodology to confirm these findings.

Since no additional authorization by Congress is required to address the dam safety issues, a DSM Report will be prepared in accordance with Draft ER 1110-2-1156, 16 July 2009.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the East Branch Dam, Elk County, Pennsylvania: Dam Safety Modification Study in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers, Draft Engineer Regulation (ER) No. 1110-2-1156, July 16 2009; Water Resources Policies and Authorities, *Civil Works Review Policy* (EC 1165-2-209), January 31, 2010; and the Office of Management and Budget *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of this IEPR is to analyze the adequacy and acceptability of economic, engineering, and environmental methods, models, data, and analyses performed for the East Branch Dam, Elk County, Pennsylvania: Dam Safety Modification Study. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by panel members with extensive experience in engineering, economics, plan formulation, and environmental issues associated with Flood Risk Management (FRM).

The panel members will be “charged” with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-209, Appendix D,

reviews should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents and reference materials that will be provided for the review. **The documents and files presented in bold font are those which are to be reviewed.** All other appendices and documents are provided as supporting information or for reference.

- **East Branch, Pennsylvania: Dam Safety Modification (DSM) Study Main Report**
 - Appendix A – Risk Assessment and Risk Management Alternative Formulation
 - Appendix B – Life Loss Consequences
 - Appendix C – Economic Evaluation and Economic Consequences
 - Appendix D – M-CACES Estimate For Recommended Plan
 - Appendix E – Environmental Documentation
 - Appendix F – PCA (N/A)
 - Appendix G – PMP for Design Phase
 - Appendix H– Schedule for Fully Funded Project Costs By Fy
 - Appendix I – Authorizing Legislation
 - Appendix J – Existing Contracts with Sponsors (N/A)
 - Appendix K – Engineering Analyses and Determination Of Compliance With Essential USACE Guidelines
 - Appendix L – Real Estate Plan
 - Appendix M – Independent External Peer Review
 - Appendix N – Agency Technical Review Documentation
 - Appendix O – Independent Advisory Panel
- **East Branch Dam, East Branch Clarion River, Elk County, Pennsylvania: Draft Environmental Assessment**
 - Appendix A – Interim Pool EA, June 2009
 - Appendix B – Correspondence
- USACE guidance *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010
- USACE Dam Safety guidance ER 1110-2-1156 (Draft 16 July 2009)
- CECW-CP Memorandum *Peer Review Process* dated March 31, 2007
- Office of Management and Budget’s *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

6.1.1 SCHEDULE

TASK	ACTION	DUE DATE
Conduct Peer Review	Review documents sent to panel members	4/20/2010
	Battelle/panel Kick-off Meeting Pending Panel Availability	4/21/2010
	USACE/Battelle/panel Kick-off Meeting with panel members Pending Panel Availability	4/23/2010
	External panel members complete their review	5/7/2010
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members merged individual comments and talking points for panel review teleconference	5/14/2010
	Convene panel review teleconference	5/18/2010
	Battelle provides final panel comment directive to panel	5/19/2010
	External panel members provide draft final panel comments to Battelle	5/26/2010
Prepare Final Panel Comments and Final IEPR Report (cont)	Battelle provides feedback to panel members on draft final panel comments; panel provides revised draft final panel comments per Battelle feedback	Not Applicable
	Final Panel Comments finalized	6/3/2010
	Battelle provides Final IEPR report to panel for review	6/7/2010
	Panel provides comments on Final IEPR report	6/9/2010
	*Submit Final IEPR Report	6/14/2010
Comment/Response Process	Input final panel comments to DrChecks Battelle provides final panel comment response template to USACE	6/15/2010
	USACE PDT provides draft Evaluator responses and clarifying questions to Battelle	6/24/2010
	Battelle provides panel members the draft Evaluator responses and clarifying questions	6/29/2010
	Panel members provide Battelle with draft BackCheck responses	7/1/2010
	Teleconference with Battelle and panel members to discuss panel's draft BackCheck responses	7/1/2010
	Final Panel Comment Teleconference between Battelle, IEPR team, and PDT to discuss final panel comments, draft responses and clarifying questions	7/2/2010
	USACE inputs final Evaluator responses in DrChecks	7/13/2010
	Battelle provides Evaluator responses to panel members	7/13/2010
	Panel members provide Battelle with BackCheck responses	7/26/2010
	Battelle inputs BackCheck responses in DrChecks	7/27/2010
	*Battelle submits pdf printout of DrChecks project file	7/28/2010

Deliverables are noted with an asterisk*

CHARGE FOR PEER REVIEW

As part of the IEPR review, members of this peer review panel are asked to determine whether the technical approach and scientific rationale presented in the East Branch Dam, Elk County, Pennsylvania: Dam Safety Modification Study are credible and whether the conclusions are valid. The reviewers are asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The panel is being asked to provide feedback on the economic, geotechnical engineering, environmental resources, and plan formulation. The reviewers are not being asked whether they would have conducted the work in a similar manner.

Specific questions relating to the IEPR review, listed by document and when applicable report section, are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the East Branch Dam, Elk County, Pennsylvania: Dam Safety Modification Study. Please focus on your areas of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-209; Appendix D).

1. Your response to the charge questions should not be limited to a “yes” or “no.” Please provide complete answers to fully explain your response.
2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.
3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluation of economic or environmental impacts of the proposed project.
4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable
7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision making.

Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review.
2. Please contact the Battelle deputy project manager (**Lynn McLeod**, mcleod@battelle.org) or project manager (Karen Johnson-Young, johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle project manager immediately.
4. Your name will appear as one of the panelists in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Lynn McLeod, mcleod@battelle.org, no later than May 7, 2010, 10 pm EDT.

**East Branch Dam, Elk County, Pennsylvania:
Dam Safety Modification Study
Independent External Peer Review**

Final Charge Questions

General Questions

1. In your expert opinion, do the main decision document, EA and appendices form an integrated and consistent product upon which to base a recommendation?
2. Please comment on the soundness of engineering evaluation as applicable and relevant to your area of expertise. Comment on whether the data presented explain past events and how engineering decisions will be validated.
3. Please comment on whether all dam safety issues and opportunities have been identified.
4. Please comment on the clarity of the description of project maintenance, including previous major rehabilitations and dam safety modifications.
5. In your expert opinion, is there sufficient information presented to identify, explain, and comment on assumptions that underlie engineering analyses. Why or why not?
6. Question eliminated from review May 6, 2010.

DAM SAFETY MODIFICATION REPORT

Section 1.0 Dam Safety Portfolio Risk Management Process

No questions.

Section 2.0 Background

7. Please comment on the adequacy of the discussion pertaining to the design and construction of the dam and appurtenant features. What, if any, key factors are missing from this discussion?
8. Please comment on the dam's performance over time in relationship to previous and current safety concerns.
 - a. Does the physical data and observed data provide adequate information to characterize the project and its performance.
 - b. Based on your experience, are there any other performance or safety concerns that should be considered and addressed?

3.0 Guiding Principles and Key Concepts

No questions

4.0 Identification of Dam Safety Issues, Risk Reduction Objectives, Limitations and Opportunities

9. Based on your experience, have all characteristics, conditions, and scenarios leading to failure, along with the potential consequences, been identified?
10. Question eliminated from review May 6, 2010.
11. Please comment on whether the dam safety study risk reduction objectives and constraints have been adequately characterized.
12. Please comment on whether all pertinent factors have been considered in the estimation of risk for the baseline condition.
13. Please comment on whether the past investigations/studies improved the quality and reduced the uncertainty of the baseline risk estimate and risk reduction estimates.
14. Have all dam safety risk management measures been considered, including structural and non-structural measures, for (a) individual significant failure modes and (b) multiple significant failure modes?
15. Please comment on whether the beneficial and adverse effects associated with the identified alternative risk management plans have been identified. Does the study provide adequate rationale for the alternatives? Why or why not?
16. Question eliminated from review May 6, 2010.
17. Please comment on the adequacy and comprehensiveness of the dam break analysis completed to estimate flood characteristics for dam failure.

5.0 Plan Formulation

18. Please comment on the formulation and evaluation of alternatives.
19. Please comment on whether adequate consideration has been given to the non-structural (NS1-NS3) and structural alternative plans (S1-S6) and their potential to address the significant dam safety issues.
20. Please comment on whether the staging of construction phases for remediation action have been given adequate consideration in the alternative plans.

6.0 Evaluation and Screening of Plans

21. Please comment on whether the risk (i.e., hazard, probability of failure, and consequences), associated costs, and changes in benefits are outlined for the failure modes associated with each alternative?
22. Please comment on whether the risk reduction associated with each alternative plan is clearly presented and compared against the baseline risk, including the cost of each alternative?
23. Please comment on whether the potential impacts of each alternative plan, and potential mitigation measures for each are adequately presented?

7.0 Recommendation

24. In your expert opinion, are all dam safety issues (credible and significant failure modes) addressed by the recommended plan? Why or why not?
25. In your expert opinion, does the recommended risk management plan achieve the desired objectives including tolerable risk guidelines, ALARP, and cost effectiveness?
26. In your expert opinion, will the recommended alternative revise the Dam Safety Action Classification (DSAC) of the dam? Why or why not?
27. Please comment on whether the effect of delaying implementation of the recommended plan is clearly outlined?
 - a. What, if any, additional consequences of not implementing, or delaying implementation of the recommended risk management plan should be included?
28. Please comment on whether the views of the principal stakeholders and other interested parties have been adequately considered or addressed?

ENVIRONMENTAL ASSESSMENT

General Questions

29. Please comment on whether all relevant engineering and scientific disciplines have been effectively integrated into the Environmental Assessment Report, taking into account that they cannot include security sensitive and loss of life information in the document. What, if anything else, should be included?
30. Comment on the adequacy and acceptability of the economic and environmental methods, models, analyses, and assumptions used.

31. Comment on the extent to which the existing conditions are clearly and adequately described.
32. Comment on the extent to which the future conditions based on each alternative are clearly and adequately described.
33. Based on your experience, are the conclusions regarding the type and projected magnitude of adverse impacts reasonable? What additional information, if any, should be included?
34. Is there any additional information that is imperative to the USACE's final NEPA assessment that has not been included in the EA or its supporting documents?
35. Based on your area of expertise, are there any additional issues that should be considered when addressing the structural and geological issues associated with this dam that have not been identified for this project? If so, what and why?
36. Comment on the completeness of the no-action, non-structural and structural plans.
37. Are risks and uncertainties of benefits, costs, and impacts adequately addressed and described? If not, what is missing?
38. Please comment on whether the recommended alternative is constructible, environmentally sustainable, within the Federal interest, and is the least cost plan that reduces risk within tolerable risk guidelines and enables East Branch to operate as Authorized.
39. Please comment on whether the impact of the seven repair alternatives on the lake and downstream fisheries has been adequately addressed.
40. Please comment on whether the recommended alternative achieves the desired objectives outlined in ER1110-2-1156 including tolerable risk guidelines, ALARP, cost effectiveness, and essential USACE guidelines?