ACER TECHNICAL MEMORANDUM NO. 10
ASSISTANT COMMISSIONER - ENGINEERING AND RESEARCH
DENVER, COLORADO

GUIDELINES FOR USING FUSE PLUG EMBANKMENTS IN AUXILIARY SPILLWAYS

U.S. DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
1987

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UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

July 1987

PREFACE

This document was developed by an ad hoc committee under the general direction of the Chief, Technical Review Staff. Members of the committee were individuals who developed and directed activities of PRESS Allocation SO-3, Development of Criteria for Use in Design of Fuse Plug Embankments in Auxiliary Spillways.

The guidelines in this document and the statements in the accompanying memorandum represent the policy of the Bureau of Reclamation for the use of fuse plug embankments.

Darrell W. Webber
Assistant Commissioner
Engineering and Research

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Memorandum

Memorandum | Denver, Colorado

TO : Assistant Commissioner - Engineering and Research

DATE: May 14, 1987

THROUGH: Chief, Office of Project Management and Review
FQ Chief, Division of Research and Laboratory Services
Chief, Division of Dam and Waterway Design
Acting Chief, Division of Dam Safety

FROM : Acting Chief, Technical Review Staff

SUBJECT : Submittal of Proposed Policy Statement Concerning Use of Fuse Plug Embankments in Auxiliary Spillways

The attached Guidelines for Using Fuse Plug Embankments in Auxiliary Spillways has been prepared by representatives of D-210, D-1500, and D-3210. The document is based in part on the results of Bureau of Reclamation PRESS allocation No. SO-3, Development of Criteria for Use in Design of Fuse Plug Embankments in Auxiliary Spillways. Laboratory model tests demonstrated that fuse plug embankments could be designed to wash out at a predictable rate when breached. The results of the laboratory research pointed out the major factors which can affect the rate of washout and how these factors may be evaluated in a quantitative manner. I believe that fuse plug embankments are a viable alternative for providing additional flood discharge capacity under certain conditions, as indicated in the guidelines.

I recommend that the attached guidelines be published as a numbered ACER Technical Memorandum.

I also recommend the following statement be adopted as the ACER policy statement regarding the use of fuse plug embankments:

> "Fuse plug embankments are a viable alternative for providing additional flood discharge capacity when used in accordance with the ACER-TM Guidelines for Using Fuse Plug Embankments in Auxiliary Spillways."

Edward W. Gray Jr.

APPROVED: 5/18/87

Dennis E Schroeder
ACTING ASSISTANT COMMISSIONER
ENGINEERING AND RESEARCH

Attachment

Copy to: D-222 (Higinbotham)
D-230 (Von Thun)
D-1532 (Pugh)
D-3210
D-3210 (Gray, Yang)

CONTENTS

GUIDELINES FOR USING FUSE PLUG EMBANKMENTS IN AUXILIARY SPILLWAYS

INTRODUCTION

A fuse plug embankment is an earthfill structure designed to wash out in a predictable and controlled manner when the water surface of the reservoir behind it reaches a specified level. The purpose of a fuse plug is to provide a safe, economical means for controlling the maximum reservoir water surface elevation by increasing discharge capabilities during major flood events. Consideration of the use of a fuse plug is based on the evaluation of interdependent criteria. Site conditions should be favorable for construction of an auxiliary spillway.

An auxiliary spillway is constructed to provide discharge capacity in addition to that provided by a service spillway and/or an outlet works. The auxiliary spillway may be located on an abutment of the dam or at some location on the reservoir rim, provided that the discharge can be directed safely into an existing water course. The additional discharge capacity provided by an auxiliary spillway may be required for existing reservoirs because hydrometeorological data acquired since construction has resulted in a revised IDF (inflow design flood) larger than the available surcharge space and existing structures can control safely. In the case of new construction, an auxiliary spillway may supplement conventional structures to provide a favorable economic alternative for making required reservoir releases. Constructing a fuse plug across the auxiliary spillway channel will prevent operation of that waterway until specified flood events have been surpassed.

GUIDELINES

The following guidelines will be used when considering the use of fuse plugs:

1. Fuse plug embankments must be designed in accordance with current, established standards.

2. Site conditions should be favorable for fuse plug location and operation. A natural saddle along the reservoir rim could minimize

excavation. Approach and exit flow conditions should be carefully evaluated. A natural topographic feature or excavated channel is required to direct flow to an existing stream course. This waterway should be reasonably erosion resistant to ensure the integrity of the dam, reservoir, and existing hydraulic structures. An auxiliary spillway channel on an abutment of the dam should be extremely erosion resistant.

3. In general, fuse plugs should be designed to operate only for floods with recurrence intervals that are long relative to the economic life of the project. Specifically, fuse plugs should not be designed to breach for floods with recurrence intervals less than 100 years.

4. Fuse plugs should be designed so that the rate of increase in reservoir outflow as the fuse plug washes out is acceptable. Splitter walls with variable elevations of control sections and/or pilot channel crest elevations can facilitate this requirement.

5. The elevation of the control section in the channel containing the fuse plug should not be lower than the top of active conservation capacity elevation, unless temporary loss of some active conservation capacity is acceptable.

6. A well-conceived operation and maintenance program is necessary to ensure that the fuse plug will operate as designed. The program should be defined in the SOP (Standing Operating Procedures) and should include the prevention of pedestrian and motorized traffic and vegetative growth on the fuse plug.

7. A fuse plug must be constructed of durable earth and rock materials which may not need to function as intended until many years after construction.

DECISION PROCESS

Fuse plug designs meeting the above guidelines should be considered and compared with alternative solutions for passing the design flood and maintaining the desired maximum reservoir elevation. The comparison should be made as a decision analysis process in which all of the factors representing costs and benefits (monetary and nonmonetary) of each alternative are clearly illustrated. The decision analysis process found in ACER Technical Memorandum No. 7, Guidelines to Decision

Analysis, may be used when applicable. The different aspects of fuse plug operation over those used with conventional auxiliary spillways (e.g., sudden increase in downstream flow, loss of reservoir storage, potential additional increase in downstream damages, costs of rebuilding after operation) will be appropriately considered in the decision analysis process for selection of alternatives.

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