



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Department of the Environment, Transport, Energy
and Communication DETEC

Swiss Federal Office of Energy SFOE
Section TS

Final Report dated December 01, 2024

Peer Review of the Swiss Dam Safety Guideline, Part C3, “Earthquake Safety”

Phase 3 – Final Chairman Report on the revised
version of the directive part C3 version 2025

Date: 01 December 2024

Location: Bern

Publisher:

Swiss Federal Office of Energy SFOE, CH-3003 Bern, www.bfe.admin.ch

Authors:

Bernard Tardieu, Académie des Technologies, France tardieu.bernard@gmail.com

Ivan Wong, Lettis Consultants International, Inc., USA, wong@lettisci.com

Ramon Secanell, Fugro Belgium S.R.L., r.secanell@fugro.com

Patrick Lignier, Tractebel ENGIE, France, patrick.lignier@tractebel.engie.com

Jonathan Hinks, Independent Consultant, UK, hinksjl@googlemail.com

SFOE Project manager: Milaine Côté, milaine.cote@bfe.admin.ch

SFOE contracts numbers: SI/300364-01, SI/300367-01, SI/300366-01, SI/300365-01, SI/300368-01

The author of this report bears the entire responsibility for the content and for the conclusions drawn therefrom.

Swiss Federal Office of Energy SFOE

Pulverstrasse 13, CH-3063 Ittigen; postal address: Swiss Federal Office of Energy SFOE, CH-3003 Bern, Phone +41 58 462 56 11 · contact@bfe.admin.ch · www.bfe.admin.ch

Contents

Contents3

Abbreviations.....4

1 Introduction5

2 Individual report on the sections regarding the determination of seismic hazard. By Ramon Secanell and Ivan Wong6

3 Individual report on the sections regarding the seismic evaluation methodologies. By Bernard Tardieu and Patrick Lignier6

Abbreviations

POE: Panel of Experts

C3-2021 Guideline: Swiss Dam Safety Guideline, Part C3, version 2021

SFOE: Swiss Federal Office of Energy

SUIhaz2015: Swiss Seismic Hazard Model carried in 2015

1 Introduction

In 2023, the SFOE initiated an external Independent Review, hereafter referred to as "Peer Review", of the Swiss Dam Safety Directive, Part C3, published in 2021 on "Earthquake Safety", referred to hereinafter as "C3-2021".

The "Peer Review" was carried out by an independent international Panel of Experts directed by a chairman, referred to hereinafter as "POE".

The SFOE published C3-2021 primarily to incorporate the Swiss Seismic Hazard Model, referred to hereinafter as "SUIhaz2015." Insights gained from the initial phase of implementing C3-2021 by the operators of water-retaining facilities in Switzerland, hereinafter referred to as the "Operators," highlighted the need for a Peer Review of C3-2021. The purpose of the Peer Review is to assess the suitability, applicability, exhaustiveness of the C3- 2021, computation assumptions, evaluate whether the recommended approaches are adequate and consider if the seismic requirements allow for possible remedial measures to be executed in accordance with the concept of proportionality (balanced approach).

The SFOE entrusted me with the role of Chairman and Expert in Dam Earthquake Engineering to lead this peer review process.

A preliminary draft of the feedback report on the C3-2021 was submitted on 30 October 2023. Following this, a meeting was organized to provide a verbal presentation of the panel's perspectives and conclusions regarding potential revisions to the C3-2021 to the SFOE experts.

The first chairman's report providing technical feedback on the C3-2021 was issued in March 2024. Subsequently, multiple rounds of discussions between the POE and SFOE experts were conducted, resulting in the finalized content presented in this report.

From our perspective, the development process of this new part of the national directive is innovative, admirable, and exemplary. This approach ensures the document remains broad in perspective, making it highly valuable to dam operators and engineers worldwide.

The overall process took slightly longer than initially anticipated. This additional time was essential to allow a common understanding among all participants, including the Swiss experts who joined the team during the process.

The panel of experts, and its chairman, wish to express their gratitude to the team of SFOE for giving them the opportunity to participate to this highly engaging and collaborative initiative.

2 Individual report on the sections regarding the determination of seismic hazard. By Ramon Secanell and Ivan Wong

We have reviewed the latest version of Directive Part C3 provided to us on 29 October 2024 with particular emphasis on Section 4 *Earthquake Load Case and Post-Earthquake Conditions* and find it to be technically sound and well written. Over the course of the review process beginning in October 2023, we have provided numerous comments on C3-2021 and associated documents most notably the *Seismic Hazard Model 2015 for Switzerland* (SUIhaz2015) and *Factsheet: Site-specific seismic hazard studies for dams: SFOE requirements (the new Annex C in the latest version of the document)*. Responses to our review comments have been adequately addressed and where appropriate. Directive Part C3 has been revised to our satisfaction. Based on the version received on 29 October 2024, we have no further comments, and we find this version ready to be implemented by the SFOE.

3 Individual report on the sections regarding the seismic evaluation methodologies. By Bernard Tardieu and Patrick Lignier

Some key concepts have been outlined in the Chairman report phase 1 to guide the drafting of the new version of Directive Part C3 on Seismic Safety. Some of these aspects are already in use as an international state of practice, while others were more innovative.

Several adjustments were made during a physical meeting in Ittigen on September 24, 2024, followed by a virtual meeting on November 25, 2024. These meetings were instrumental in ensuring that all participants fully understood the various conceptual approaches proposed, thereby assisting the SFOE in achieving the final draft. The final version was sent to us on 29 November 2024.

We believe that this final document accurately reflects our insights, our experience and the state of the art in seismic safety evaluation of dams. We consider the final draft dated 29 November 2024 to be ready for implementation by the SFOE.