UG 210-21-10 ENG Availability of Seismic Analysis of Risers Software (SARisers)

User Guide: 210-21-10 **Date:** June 7, 2021

Subject: ENG – Availability of Seismic Analysis of Risers Software (SARisers)

Purpose. This user guide announces the availability of Seismic Analysis of Risers Software (SARisers).

Effective Date. Effective upon receipt.

Background. SARisers is a computer program based on the criteria and procedures of Technical Release (TR)-68 for the analysis of drop inlet spillway risers subjected to earthquake motion. Appendix D to TR-68 describes the computer program that performs seismic analysis of a drop inlet spillway riser with standard covered top (TR-30) or standard baffle inlet top (TR-70). The program was originally written in GW-BASIC and compiled with QuickBASIC to run using a Disk Operating System (DOS). SARisers now can be run using VDos. Later revisions were made to the program in 1993.

Please note that structural design experience is needed to use the software correctly and safely. Before using this program, the user should become familiar with TR-68, TR-68 Amendment 1, and TR-68 Amendment 2.

Attachment A, SARisers Variable Input Guidance, provides additional information (as noted in National Engineering Manual (NEM), Part 536, "Structural Engineering") regarding how to input values in the software to correspond with current American Society of Civil Engineer's Minimum Design Loads for Buildings and Other Structures (ASCE 7) seismic parameters.

Special Instructions. Natural Resources Conservation Service (NRCS) users may obtain SARisers by contacting the National Design, Construction, and Soil Mechanics Center (NDCSMC) point of contact shown below. VDos can be obtained from the NRCS Software Center and self-installed by the user.

Distribution. This user guide will be distributed through the eDirectives System.

Filing Instructions. There are no formal requirements. Users retaining a hard copy of the program documentation should file the hard copy with other design criteria pertaining to drop inlet spillway risers.

Contact. Users may direct questions or comments regarding the software to the appropriate State-level staff engineer or to John Van Leeuwen, Structural Engineer, NDCSMC, Fort Worth, TX, at (817) 509-3758, or by email to john.vanleeuwen@usda.gov.

/s/

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Attachment A - SARisers Seismic Variable Input Guidance

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National Engineering Manual (NEM), Part 536, "Structural Engineering," paragraph 536.21.D.(1), Design Criteria for Reinforced Concrete Hydraulic and Environmental Structures states the following:

> (1) For utilization with the computer program SARisers, combine the values for the zone "Z" and the site classification "S" to produce a base shear approximately equal to the base shear obtained using the methods described in the American Society of Civil Engineer's Minimum Design Loads for Buildings and Other Structures (ASCE 7). When interpolation of the combined zone and site class value is required, input the next higher value into the computer program.

The seismic design methodology used in SARisers program has evolved over time, but the basic principles are the same. The program input can be adjusted to reflect current seismologic methods, to some extent. This is accomplished by calculating a structure's design base shear in accordance with the latest edition of ASCE 7. Then, selecting the SARisers input values to approximate that design base shear. This primarily will require the user to adjust the Zone (which will modify the Zone Factor) and the Hazard Classification (which will modify the Serviceability Factor).

TR68 Equation 13 shows the equivalent base shear as: $\mathbf{V_0 = (ZSRC)W_T}$ where

- **Z** = Seismicity Zone Factor: 0.25 for zone 1, 0.50 for zone 2, 1.00 for zone 3, and 1.33 for zone 4.
- **S** = Serviceability Factor (originally tied to hazard class): 1.0 for Dam Class A (Low Hazard Potential), 1.5 for Dam Class B (Significant Hazard Potential), and 2.0 for Dam Class C (High Hazard Potential).
- **R** = Structural Response Factor for tower structures: The program uses 2.00 for risers.
- **C** = Base Shear Coefficient: Per TR68, based on the fundamental period of vibration (C=0.05/T^.333) not greater than 0.10.
- $\mathbf{W_T}$ = Total effective weight of the structure.

The program coding calculates many of the values and the user can adjust the Z and S factors to obtain a base shear approximately equal to the base shear obtained using the methods described in the current version of ASCE 7. As noted in the NEM, when interpolation of the combined Z and S values is required, input of the next higher value into the software is recommended.

TR 68 Values for Z·S·R·C

Program uses R =2.00 and C=0.10

TR 68 Zone	Zone Factor Z =	TR 60 Dam Class A	TR 60 Dam Class B	TR 60 Dam Class C
		Serviceability Factor S =		
		1.000	1.500	2.000
1	0.250	0.050	0.075	0.100
2	0.500	0.100	0.150	0.200
3	1.000	0.200	0.300	0.400
4	1.330	0.266	0.399	0.532

Example:

As an example, for a riser in zone 1 with a high hazard potential, if the base shear was determined to be 0.15W per ASCE 7 methods, then in order to approximate the value in SARisers, a Zone value of "2" and Hazard Class value of "B" could be input into the program to obtain that same value, regardless of the actual Zone and Hazard Class values for the dam. If the actual Zone value of "1" and Hazard Class value of "C" were input then, as the table shows, the design base shear of 0.10W, which is less than the value calculated in accordance with ASCE 7 and, therefore, lead to unconservative stability factors of safety and reinforcement design.