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From: "T. Leslie Youd" <tyoud@byu.edu>
To: <nrcweb@nrc.gov>
Date: 6/15/01 1:43PM
Subject: Comments on Draft Regulartory Guide DG-1105

Attention: Jake Philip

I am submitting the attachedcomments on Draft Guide DG-1105 "Procedures and Criteria for Assessing Seismi Soil Liquefaction at Nuclear Power Plant Sites." Please contact me if you can not retrieve that attached comments or if you have questions on any of the comments I have made.

Sincerely yours;

T. Leslie Youd
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Template = ADM-013

E-RIDS = ADM-03
Add = J. Philip (5 x P)
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MEMORANDUM

Date: June 15, 2001

From: T. Leslie Youd

To: J. Phillip

Re: Draft Regulatory Guide DG-1105

I have reviewed Draft Regulatory Guide DG-1105 entitled "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites" and offer the following unsolicited comments.

1. General comments:

1.1. The draft guide relies heavily on procedures developed for by the US Army Corps of Engineers for evaluating liquefaction hazard for large earth dams and, in my opinion, does not adequately consider procedures routinely used in assessment of liquefaction hazard for buildings, bridges, pipelines, and other typical civil infrastructure. As such, the report over emphasizes reliance on cyclic laboratory strength and centrifuge tests and does not consider standard procedures for evaluating bearing capacity for both shallow and deep foundations, lateral spread displacement, and ground settlement. Standard procedures are available for these hazards, which are important for nuclear power plant structures, that are not mentioned in the draft guide. These issues were recently thoroughly considered by a committee of experts in California and guidelines written. These guidelines are published in: "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California," 1999, G. R. Martin and M. Lew, editors, published by the Southern California Earthquake Center (SCEC), University of Southern California. I believe that these procedures should be considered in the design of nuclear power plant facilities.

1.2. I and Prof. I.M. Idriss convened a two workshops under the sponsorship of NCEER and NSF to thoroughly review and update procedures for evaluating liquefaction resistance of soils. The NCEER report from the workshop are referred to in the report, but a subsequent paper has been published that further updates the procedure. This paper should be cited with other references to procedures mentioned in the guide. I also believe that more consideration should be added to the draft guidelines to the procedures recommended from the workshops. Those procedures were thoroughly considered by the 20 experts on liquefaction that participated in the workshop and

have become the standard of practice used in geotechnical engineering practice throughout North America. Most consultants will likely be more familiar and have more confidence in these procedures than many of the procedures recommended in the Draft Guide. That paper will be republished shortly to correct errors in authorship as: Youd, T.L. et al., 2001, Liquefaction Resistance of Soils: Summary Report from t he 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 127, No. 10, in press.

2. Specific comments:

2.1. Page 6, first paragraph. When liquefiable sediments are contained to prevent flow failure and lateral spread, damaging ground oscillations may occur as well as ground settlement.

2.2. Page 6, Analytical Methods. Analytical methods are difficult to apply due to the need for constitutive relationships that are difficult to define for liquefiable sites. Thus, analytical procedures should only be recommended for critical structures where the more widely used and generally more reliable empirical techniques are inadequate to fully assess soil deformations. I agree that for critical structures, such as some structures at nuclear power plants, the empirical techniques may not always be adequate and analytical procedures should be recommended, but generally only for those critical structures. If mitigation, such as ground modification, is going to be required anyway, requirements and quality assurance will generally be based on conservative application of the empirical techniques rather than analytical techniques, making the need for analytical techniques of lesser importance.

2.3. Page 7, Physical Modeling. One can not adequately model a natural site with all of its geologic detail in a centrifuge test. Centrifuge tests are very useful for modeling and testing the performance of specific simplified soil and loading conditions, but are not adequate for modeling a site. The Draft Guide should clearly state the benefits and limitations of simulation studies in a centrifuge.

2.4. Page 7, last paragraph. Reference is needed to procedures developed by Robertson and Wride for evaluating liquefaction from CPT. Those procedures are the basis for procedures recommended in the NCEER workshop proceedings. Reference to the paper by Robertson and Wride in the workshop proceedings or a later publication in the Canadian Geotechnical Journal should be added to this paragraph.

2.5 Page 8, first paragraph. The discussion of criteria based on measured shear wave velocities is too restrictive. If such restrictions on the imposed, then the specific limitations to soil and other conditions should be specified. Many shear wave velocity tests have been made and are being made at a wide variety of sites and soil conditions that were subjected to a wide range of seismic loading conditions. The conditions for which shear wave velocity techniques are applicable will be greatly enlarged in the near future. This test is very useful for sites where SPT and CPT are not recommended, such as gravelly sites and areas where bore holes and soundings are not permitted. Shear wave velocity measurement is a viable technique that should not be discouraged to the extent implied in this paragraph.

2.6 Page 8, last paragraph under Section 1.1. Shear wave velocity measurements should be suggested as well as Becker penetration tests for gravelly and cobbley sites.

2.7 Page 9, Section 1.3. The procedure recommended here for estimating SPT N-values from CPT data is obsolete and of questionable validity, and should no longer be recommended for engineering practice. More reliable criteria are available for CPT, such as those recommended in the NCEER workshop report.

2.8 Page 9, Section 1.5. Same as comment 2.5 above.

I hope these few comments are useful to you in developing a final Guide for evaluating liquefaction hazard at nuclear power plant sites. If you have questions on my comments or need further information, please feel free to contact me.