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Deborah L. Markowitz
Agency Secretary

Trey Martin
Deputy Secretary

State of Vermont
Agency of Natural Resources

June 22, 2015

Dear Governor Shumlin,

The Vermont Agency of Natural Resources seeks authorization under 30 V.S.A. § 20(a)(2) to retain an expert witness to assist the Agency in offering evidence and recommendations regarding the proposed second independent spent fuel storage installation ("ISFSI") for the Vermont Yankee Nuclear Power Station in Vernon, Vermont. The ISFSI is proposed to house the spent fuel currently being stored in the spent fuel pools. One of the issues that arose in the first ISFSI docket and is anticipated in this docket is the stability of the soils and seismic risks associated with the site and the weight of the storage pad. At the time it filed its Petition in June 2015, Entergy did not yet have the soil data to confirm that the soils were sufficiently stable to support the storage pad installation. Entergy has since conducted additional studies which reveal "that there are a few deep isolated 'pockets' of soil of limited thickness beneath the location selected for the second ISFSI Pad that under design basis earthquake conditions were determined to be potentially liquefiable with a limited level of associated settlement."

ANR would like to assess the soil data and review Entergy's analysis, modeling, and supporting materials. Marjorie Gale, the state geologist has recommended we retain Mandar Dewoolkar, Ph.D, P.E., to assist her in the review of this information. Dr. Dewoolkar is an Associate Professor and Program Head of Civil & Environmental Engineering at UVM's School of Engineering.

The services are estimated to cost no more than \$20,000. If it becomes necessary to exceed this maximum the Agency will notify Entergy prior to any expenditure. I have attached a memorandum with additional details regarding this request.

Sincerely,

A handwritten signature in black ink, appearing to read "Deb Markowitz", written over a horizontal line.

Deb Markowitz, Secretary

MEMORANDUM

To: Governor Peter Shumlin *PJS*

Through: Deb Markowitz, Secretary, Agency of Natural Resources *DM*

From: Jen Duggan, General Counsel, Agency of Natural Resources *Jen Duggan*

Date: June 22, 2015

Re: Public Service Docket No. 8300: Entergy Vermont Yankee, Request to approve bill back authority for retaining soils engineer as expert witness in connection with the proposed independent spent fuel storage installation ("ISFSI") project

The Vermont Agency of Natural Resources seeks authorization under 30 V.S.A. § 20(a)(2) to retain an expert witness to assist it in offering evidence and recommendations regarding the proposed second independent spent fuel storage installation ("ISFSI") for the Vermont Yankee Nuclear Power Station in Vernon, Vermont. The ISFSI is proposed to house the spent fuel currently being stored in the spent fuel pools. One of the issues that arose in the first ISFSI docket and is anticipated in this docket is the stability of the soils and seismic risks associated with the site and the weight of the storage pad. At the time it filed its Petition in June 2015, Entergy did not yet have the soil data to confirm that the soils were sufficiently stable to support the storage pad installation. Entergy has since conducted additional studies which reveal "that there are a few deep isolated 'pockets' of soil of limited thickness beneath the location selected for the second ISFSI Pad that under design basis earthquake conditions were determined to be potentially liquefiable with a limited level of associated settlement." Supplemental Testimony of George Thomas at 3.

ANR would like to assess the soil data and review Entergy's analysis, modeling, and supporting materials. Marjorie Gale, the state geologist, has recommended we retain Mandar Dewoolkar, Ph.D, P.E., to assist her in the review of this information. Dr. Dewoolkar is an Associate Professor and Program Head of Civil & Environmental Engineering at UVM's School of Engineering. During the first ISFSI proceeding, Dr. Dewoolkar assisted then state geologist, Larry Becker in reviewing the petition, providing testimony and appearing at the technical hearing. Dr. Dewoolkar has 15 years of experience as a researcher, consultant and educator. He specializes in soil mechanics. His expertise is in applying physical and numerical modeling and field and laboratory testing techniques to study effects of environmental loadings on natural and manmade materials and structures.

Dr. Dewoolkar received his Ph.D from the University of Colorado at Boulder's Department of Civil, Environmental and Architectural Engineering. Dr. Dewoolkar's CV is attached.

Dr. Dewoolkar's consulting rate is \$200.00 an hour. The Agency requests approval to contract with Dr. Dewoolkar for the following services:

1. Provide technical review of Petitioner's testimony, exhibits, and responses to discovery.
2. Assist Agency counsel and staff in developing discovery questions.
3. Prepare direct examination and surrebuttal testimony, prepare responses to discovery, and prepare for technical hearing.
4. Assist Agency staff and counsel in the preparation for technical hearings and review of post-hearing briefing.
5. Provide analysis, comments, and otherwise assist the Agency in its review of the project and its presentation to the Public Service Board.

The services are estimated to cost no more than \$20,000. If it becomes necessary to exceed this maximum the Agency will notify Entergy prior to any expenditure.

In addition, ANR intends to avail itself of the bill back provision of 30 V.S.A. § 21, for the portion of costs and expenses of ANR employees for their work related to the proceedings in Public Service Board Docket # 8300. ANR expects to exceed the \$3,000 threshold in connection in this matter.

The Agency has provided Petitioner's counsel with notice of its intent to use billback to retain Dr. Dewoolkar and for the portion of costs and expenses of ANR employees. See attached correspondence.

Mandar M. Dewoolkar, Ph.D., P.E.

Associate Professor and Program Head of Civil & Environmental Engineering
School of Engineering, University of Vermont
301 Votey Hall, 33 Colchester Ave., Burlington, VT 05405
Tel: (802) 656 1942, E-mail: mandar.dewoolkar@uvm.edu

EDUCATION**University of Colorado at Boulder**

Ph.D., Department of Civil, Environmental and Architectural Engineering, December 1996.

Indian Institute of Technology, Mumbai, India

M.Tech., Department of Civil Engineering, August 1992.

University of Bombay, India

B.E., Civil Engineering, July 1990.

EMPLOYMENT

September 2012 - present	University of Vermont Program Head, Civil & Environmental Engineering
September 2009 - present	University of Vermont Associate Professor, School of Engineering
September 2003 – August 2009	University of Vermont Assistant Professor, School of Engineering
September 2000 – August 2003	GEI Consultants, Inc. , Englewood, Colorado Geotechnical Engineer
	Colorado School of Mines , Golden, Colorado Adjunct, Division of Engineering
	University of Colorado at Boulder Visiting Lecturer, Civil, Environ. & Architectural Eng.
January 1997 – July 2000	University of Colorado at Boulder Research Associate, Civil, Environ. & Architectural Eng.

AWARDS

- Sustainability Faculty Fellow at the University of Vermont, 2012 – 13.
- Vermont Campus Compact's Engaged Scholar Award, 2011.
- The Erasmus Mundus International Visiting Scholar, International Consortium of Structural Analysis of Monuments and Historical Construction, September – December 2010 at the University of Minho, Portugal.
- Outstanding Service Learning Faculty Award, 2010.
- University of Vermont's Kroepsch-Maurice Excellence in Teaching Award, 2007.
- Service-Learning Faculty Fellow at the University of Vermont, 2006 – 07.

CONSULTING

- GEI Consultants, Inc., Englewood, CO
- RJH Consultants, Englewood, CO
- Vermont Agency of Natural Resources
- Civil Engineering Associates, South Burlington, VT

PROFESSIONAL LICENSURE

P.E. in California since 2000, No. C 59882 (since 1999)

PUBLICATIONS**Journal Publications**

- 1) Dewoolkar, M. M., Hargy, J., Anderson, I., de Alba, P., and Olson, S. M., "Residual and post-liquefaction strength of a liquefiable sand", *Journal of Geotechnical and Geoenvironmental Engineering*.
- 2) Anderson, I., and Dewoolkar, M. M., "Durability of fly ash pervious concrete for freeze-thaw in a simulated field environment", *ACI Materials Journal*, accepted.
- 3) Gomez, B. W., Dewoolkar, M. M., Lens, J. E., and Benda, C. C. (2014), "Effects of fines content on hydraulic conductivity and shear strength of granular structural backfill", *Transportation Research Record*, No. 2462, 1-6.
- 4) Suozzo, M., and Dewoolkar, M. M. (2014), "Evaluation of strength and hydraulic testing methods of pervious concrete", *ACI Materials Journal*, 111(1), 23-34.
- 5) Hu, L., Savidge, C., Rizzo, D., Hayden, N. Hagadorn, W., and Dewoolkar, M. (2013), "Commonly used porous building materials: geomorphic pore structure and fluid transport", *Journal of Materials in Civil Engineering*, 25(12), 1803-1812.
- 6) Oka, L. G., Dewoolkar, M. M., and Olson, S. (2012), "Effects of existing earth dams on liquefaction potential analysis of foundation soils", *Soil Dynamics and Earthquake Engineering*, 43, 33-44.
- 7) Suozzo, M. J., and Dewoolkar, M. M. (2012), "Long-term field monitoring and evaluation of maintenance practices of pervious concrete pavements in Vermont", *Transportation Research Record*, No. 2292, Maintenance and Preservation, 94-103.
- 8) Bielefeldt, A. R., Dewoolkar, M. M., Caves, K. M., Berdanier, B. W., and Paterson, K. G. (2011), "Diverse models for incorporating service projects into engineering capstone design courses", *International Journal of Engineering Education*, 27(4), 1-15.
- 9) Hayden, N. J., Rizzo, D. M., Dewoolkar, M., Neumann, M. D., Lathem, S., and Sadek, A. (2011), "Incorporating a Systems Approach into Civil and Environmental Engineering Curricula: Effect on Course Redesign, and Student and Faculty Attitudes", *Advances in Engineering Education*, Summer Issue.
- 10) Dewoolkar, M. M., Porter, D., and Hayden, N. J. (2011). "Service-learning in engineering education and heritage preservation", *International Journal of Architectural Heritage Conservation, Analysis and Restoration*, 5, 613-628.
- 11) McCain, G. N., and Dewoolkar, M. M. (2010), "Porous concrete pavements: mechanical and hydraulic properties", *Transportation Research Record*, No. 2164, Washington D.C., 66-75.
- 12) Dewoolkar, M. M., George, L. A., Hayden, N. J., and Rizzo, D. M. (2009), "Vertical integration of service-learning into civil and environmental engineering curricula", *International Journal of Engineering Education*, 56(6), 1257-1269.
- 13) Dewoolkar, M. M., George, L. A., Hayden, N. J., and Neumann, M. (2009), "Hands-on undergraduate geotechnical engineering modules in the context of effective learning pedagogies, ABET outcomes, and curricular reform", *J. of Professional Issues in Engineering Education and Practice*, 135(4), 161-175.
- 14) George, L. A., Dewoolkar, M. M., and Znidarcic, D. (2009), "Simultaneous laboratory measurements of acoustic and hydraulic properties of unsaturated soils", *Vadose Zone Journal*, 8(3), 633-642, doi: 10.2136/vzj2008.0139.

- 15) Dewoolkar, M. M., Chan, A. H. C., Ko, H. Y., and Pak, R. Y. S. (2008), "Finite element simulations of seismic effects on retaining walls with liquefiable backfills", *International Journal for Numerical and Analytical Methods in Geomechanics*, 33(6), 791-816, DOI: 10.1002/nag.748.
- 16) Dewoolkar, M. M., Hwang, J., and Ko, H. Y. (2008), "Physical and finite element modeling of lateral stability of offshore skirted gravity structures subjected to iceberg impact load", *Ocean Engineering*, 35(16), 1615-1626, doi:10.1016/j.oceaneng.2008.08.005.
- 17) Doris, J. J., Rizzo, D. M., and Dewoolkar, M. M. (2007), "Forecasting vertical ground surface movement from shrinking/swelling soils with artificial neural networks", *International Journal for Numerical and Analytical Methods in Geomechanics*, 32(10), 1229-1245, DOI: 10.1002/nag.666.
- 18) Dewoolkar, M. M., Santichaianant, K., and Ko, H. Y. (2007), "Centrifuge modeling of granular soil response over active circular trapdoors", *Soils and Foundations*, 47(5), 931-945.
- 19) Wei, C. and Dewoolkar, M. M. (2006) "A simple formulation of capillary hysteresis with internal state variables", *Water Resources Research*, 42, W07405, 1-16.
- 20) Dewoolkar, M. M., and Huzjak, R. J. (2005) "Drained residual shear strength of some claystones from Front Range Colorado", *Journal of Geotechnical and Geoenvironmental Engineering*, 131(12), 1543-1551.
- 21) Dewoolkar, M. M., Goddery, T., and Znidarcic, D. (2003) "Centrifuge modeling for undergraduate geotechnical engineering education", *Geotechnical Testing Journal*, 26(2), 201-209.
- 22) Hwang, J., Dewoolkar, M., and Ko, H-Y. (2002), "Stability analysis of two-dimensional excavated slopes considering strength anisotropy", *Canadian Geotechnical Journal*, 39, 1026-1038.
- 23) Dewoolkar M. M., Ko, H. Y., and Pak, R. Y. S. (2001). "Seismic behavior of cantilever retaining walls with liquefiable backfills", *Journal of Geotechnical and Geoenvironmental Engineering*, 127(5), 424-435.
- 24) Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (2000), "Experimental developments for studying static and seismic behavior of retaining walls with liquefiable backfills", *Soil Dynamics and Earthquake Engineering*, 19(8), 583-594.
- 25) Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (1999), "Centrifuge modelling of models of seismic effects on saturated earth structures", *Geotechnique*, 49(2), 247-266.
- 26) Dewoolkar, M. M., Ko, H. Y., Stadler, A. T., and Astanek, S. M. F. (1999), "A substitute pore fluid for seismic centrifuge modeling", *Geotechnical Testing Journal*, 22(3), 196-210.

Book Chapter:

- 27) Rizzo, D.M., M.M. Dewoolkar and N.J. Hayden (2013), "Transferable Skills Development in Engineering Students: Analysis of Service-Learning Impact," Book Chapter in *Philosophy and Engineering: Reflections on Practice, Principles and Process*, D. P. Michelfelder, N. McCarthy, and D. E. Goldeberg (eds.), Springer Press, 65-78.

In-review Journal Manuscripts:

- 28) Edwards, M. B., Dewoolkar, M. M., and Huston, D. R., "Geotechnical properties of Fillite – a simulant for planetary high-slip/high-sinkage rover mobility studies", *Journal of Aerospace Engineering*.

- 29) Edwards, M. B., Dewoolkar, M. M., Huston, D. R., Creager, C., "Pressure sinkage modeling of Fillite for planetary rover applications", *Journal of Terramechanics*.
- 30) Hagan, D., Dubief, Y., and Dewoolkar M., "Numerical simulation of particle bed scour by vortices", *Journal of Turbulence*.
- 31) Borg, J. L., Bierman, P. R., Dewoolkar, M. M., Rizzo, D. M., and Rood, D., "Meteoric ^{10}Be adhered to suspended sediment: source and transport dynamics in a large New England watershed", in review, *Journal of Geophysical Research – Earth Surface*, in revision.

Invited Publications

- 32) Huston, D. R., Burns, D. C., and Dewoolkar, M. M. (2014), "Integration of automated and robotic systems with BIM for comprehensive structural assessment", 6WCSCM (6th World Conference of the Association for Structural Control and Monitoring, July 15-17, Barcelona, Spain. (Invited lecture)
- 33) Bryson, L. S., Acheampong, K., Bandini, P., Bhatia, S., Dewoolkar, M., Iskander, M., Reddy, K. R., Streich, V., Sukumaran, B., and Culligan, P. J. (2013), "Diversity in Geo-Engineering", *Geo-Strata*, November/December issue, 38-41.
- 34) Dewoolkar, M. M., Huzjak, R. J., and Castro, G. (2005) "Application of finite element analysis in the geotechnical design aspects of a new earth dam", *The Journal of Dam Safety*, March, 29-39.
- 35) Ko, H. Y. and Dewoolkar, M. M. (1998), "Modeling liquefaction in centrifuges", *International Workshop on the Physics and Mechanics of Soil Liquefaction*, Lade & Yamamuro (eds), Balkema, Rotterdam, September, 307-322. (Invited lecture)
- 36) Dewoolkar, M. M. and Ko, H. Y. (1998), "A study of seismic effects on retaining walls and philosophies behind centrifuge modeling", *Proceedings of the Fifth U.S.-Japan Workshop on Geotechnical Earthquake Engineering: Soil Dynamics Studies by Use of Centrifuge*, Tokyo, Japan. (Invited lecture)

Peer-Reviewed Conference Publications

- 37) Lens, J. E., and Dewoolkar, M. M. (2015), "Are there gender differences in the value that civil and environmental engineering students place on service provided through service-learning projects?", *GeoCongress 2015*, San Antonio, Texas.
- 38) Anderson, I., Rizzo, D., Huston, D. and Dewoolkar, M. M., "System-wide assessment of vulnerability of bridges to scour under extreme flood events", 7th *Int. Conf. on Structural Health Monitoring of Intelligent Infrastructure*, Torino, Italy, July 2015.
- 39) Edwards, M., Dewoolkar, M. M., and Huston, D. (2014), "Characterization of Fillite as a potential Martian regolith simulant", *Earth and Space 2014*, 14th *ASCE International Conf. on Engineering, Science, Construction and Operations in Challenging Environments* (oral presentation).
- 40) Borg, J., Dewoolkar, M. M., and Bierman, P. (2014), "Assessment of streambank stability – a case study", *Geo-Congress 2014 Technical Papers*: pp. 1007-1016, doi: 10.1061/9780784413272.098 (Oral presentation)
- 41) Anderson, I. A., Dewoolkar, M. M., Rizzo, D. M., and Huston, D. R. (2014), "Vermont bridge scour rating analysis: looking toward utilizing geomorphic stream data", *Geo-Congress 2014 Technical Papers: Geo-Characterization and Modeling for Sustainability*: pp. 2665-2674, (doi: 10.1061/9780784413272.257). (Poster presentation)

- 42) Anderson, I., Dewoolkar, M. M., Hargy, J., and de Alba, P. (2014), "Measurement of post-earthquake strength of liquefiable soils in centrifuge models", 8th International Conference Physical Modeling in Geotechnics, Perth, Australia, January 14-17.
- 43) Suozzo, M. J., and Dewoolkar, M. M. (2012), "Long-term field monitoring and evaluation of maintenance practices of porous concrete pavements in Vermont", TRB Annual Meeting, paper 12-3978, Washington DC, January 22-26. (Poster presentation)
- 44) Anderson, I., Hargy, J., de Alba, P., and Dewoolkar, M. M. (2012), "Measurement of residual strength of liquefied soil in centrifuge models", GeoCongress 2012 Conference, ASCE, pages 1740-1749, Oakland, CA, March 25-29. (Oral presentation)
- 45) Berry, B., Suozzo, M. J., Anderson, I. A., and Dewoolkar, M. M. (2012), "Properties of pervious concrete incorporating recycled concrete aggregate", TRB Annual Meeting, paper 12-3994, Washington DC, January 22-26. (Poster presentation)
- 46) Dewoolkar, M. M., Lens, J. E., and Hayden, N. J. (2012), "Service-learning design projects to enhance geotechnical engineering education", GeoCongress 2012 Conference, ASCE, pages 1283 - 1292, Oakland, CA, March 25-29. (Oral presentation)
- 47) Hayden, N.J., Rizzo, D. M., Dewoolkar M. M., Oka, L. G., and Neumann, M. (2010), "Incorporating systems thinking and sustainability within civil and environmental engineering curricula at UVM," ASEE St. Lawrence Section Meeting, RIT, March 26 and 27.
- 48) McCain, G. N. and Dewoolkar, M. M. (2009), "Porous concrete pavements: mechanical and hydraulic properties", *Transportation Research Board 2009 Annual Meeting*. (Poster presentation)
- 49) McCain, G. N., Suozzo, M. J., and Dewoolkar, M. M. (2009), "A laboratory study on the effects of winter surface applications on the hydraulic conductivity of porous concrete pavements", *Transportation Research Board 2009 Annual Meeting*. (Poster presentation)
- 50) McCain, G. N. and Dewoolkar, M. M. (2008), "Strength and permeability characteristics of porous concrete pavements", *Transportation Research Board 2008 Annual Meeting*. (Oral presentation)
- 51) George, L. A., Dewoolkar, M. M., and Wei, C. (2008) "A device for simultaneous measurement of acoustic and hydraulic properties of unsaturated soils", *Proceedings of the First European Conference on Unsaturated Soils, E-UNSAT*, Toll G., Augarde, Gallipoli, and Wheeler (eds), July 2-4, 2008, Durham, UK, 97-102. (Oral presentation)
- 52) Dewoolkar, M. M., George, L. A., and Hayden, N. J. (2008), "Research-based and service-learning modules for undergraduate geotechnical engineering courses", *GeoCongress 2008, Geosustainability and Geohazard Mitigation*, ASCE Geotechnical Special Publication No. 178, Reddy, Khire, and Alshawabkeh (eds), March 9-12, New Orleans, Louisiana, 813-820. (Oral presentation)
- 53) Porter, D., Dewoolkar, M. M., and Hayden, N. J. (2008), "The role of service-learning in heritage preservation and engineering education", *6th International Conference on Structural Analysis of Historical Construction, SAHC08*, D' Ayala and Fodde (eds), July 2-4, Bath, United Kingdom, Vol. 2, 1369-1374. (Oral presentation)
- 54) Oka, L. G., and Dewoolkar, M. M. (2007), "Effect of existing dams on liquefaction potential analysis of foundation soils", *GeoDenver 2007 New Peaks in Geotechnics, Dynamic Response and Soil Properties*, ASCE Geotechnical Special Publication No. 160, Dewoolkar and Koester (eds). (Oral presentation)

- 55) Wei, C. and Dewoolkar, M. M. (2006), "A deductive scheme for modeling hysteresis of capillarity", *Unsaturated Soils 2006, ASCE Geotechnical Special Publication No. 147*, Miller, Zapata, Houston & Fredlund (eds), Carefree, Arizona, 2420-2431. (Oral presentation)
- 56) Wei, C. and Dewoolkar, M. M. (2006), "A continuum theory of immiscible two-phase flow through porous media with dynamics and hysteresis of capillarity", *Advances in Unsaturated Soil, Seepage, and Environmental Geotechnics, Proceedings of Sessions of GeoShanghai*, ASCE Geotechnical Special Publication No. 148, Lu, Hoyos and Reddi (eds), Shanghai, 246-254. (Oral presentation)
- 57) Dewoolkar, M. M., Hwang, J., and Ko, H. Y. (2006), "Lateral stability of offshore skirted gravity structures", *Int. Conf. on Physical Modeling in Geotechnics*, Ng, Zhang and Wang (eds), Hong Kong, 631-637.
- 58) Dewoolkar, M. M., Santichaianant, K., Ko, H. Y., and Goddery, T. (2000), "Effects of sinkholes on earth dams", *Slope Stability 2000, ASCE Geotechnical Special Publication No. 101*, Griffiths, Fenton and Martin (eds), Denver, Colorado, 129-141. (Oral presentation)
- 59) Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (1998), "Effect of flexural stiffness on static and dynamic behavior of cantilever retaining walls", *Geotechnical Earthquake Engineering and Soil Dynamics III, ASCE Special Publication No. 75, Vol. 2*, Dakoulas, Yegian and Holtz (eds), Seattle, Washington, 1083-1094. (Oral presentation)
- 60) Dewoolkar, M. M., Ko, H. Y., Pak, R. Y. S., and Chan, A. H. C. (1998), "Duxseal boundary in retaining wall configuration", *ISSMFE Centrifuge 98*, Kimura, Kusakabe and Takemura (eds), Tokyo, Japan, 123-128.
- 61) Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (1998), "Suitability of total stress gages for static and dynamic soil pressure measurements", *ISSMFE Centrifuge 98*, Kimura, Kusakabe and Takemura (eds), Tokyo, Japan, 129-134.
- 62) Stadler, A. T., Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (1995), "Seismic earth pressure studies on a cantilever retaining wall by centrifuge modeling", *Proceedings of IS-TOKYO'95, First International Conference on Earthquake Geotechnical Engineering*, Vol. 2, Ishihara (ed), Tokyo, Japan, 14-16 November, 723 - 728.
- 63) Stadler, A. T., Dewoolkar, M. M., Ko, H. Y., and Pak, R. Y. S. (1995), "Centrifuge modeling of a cantilever retaining wall subjected to seismic loads", *Proceedings of 10th Conference, Engineering Mechanics*, Vol. 1, Sture (ed), Boulder, Colorado, U.S.A., May, 273-276. (Oral presentation)
- 64) Dewoolkar, M. M., Stadler, A. T., Batiste, S. N., Ko, H. Y., and Pak, R. Y. S. (1995), "Dynamic centrifuge experiment on a cantilever retaining wall", *3rd Int. Conf. on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics*, Vol. 3, Prakash (ed), 273-276.

Non Peer-Reviewed Conference Publications

- 65) Anderson, I. A., Dewoolkar, M., Rizzo, D. M., Frolik, J., and Huston, D. (2014), "Targeted deployment of scour monitoring sensors for at-risk bridges", *Proc. SPIE 9061, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, 90611J, March 2014; doi: [10.1117/12.2045368](https://doi.org/10.1117/12.2045368), p.6. (Oral presentation)
- 66) Anderson, I. A., Dewoolkar, M. M., Rizzo, D. M., and Huston, D. R. (2014), "Scour related Vermont bridge damage from Tropical Storm Irene", *Structures Congress 2014*, Boston, Massachusetts, pp. 505-515. doi: [10.1061/9780784413357.046](https://doi.org/10.1061/9780784413357.046). (Oral presentation)

- 67) Huston, D. R., Burns, D., and Dewoolkar, M. M. (2014), "Integration of Automated and Robotic Systems with BIM for Comprehensive Structural Assessment", Structures Congress 2014, Boston, Massachusetts, pp. 2765-2776. doi: 10.1061/9780784413357.242. (Oral presentation)
- 68) Hayden, N., Dewoolkar, M., Rizzo, D., and Neumann, M. (2010), "Incorporating service-learning projects dealing with sustainability within the civil and environmental engineering capstone design course", Capstone Design Conference, June 7-9, Boulder, Colorado. (Poster presentation)
- 69) Savidge, C. R., Hu, L. B., Hayden, N. J., Rizzo, D., and Dewoolkar, M. M. (2008), "Variability in surface permeability of porous building substrates and their implications on transport of agents", Chemical and Biological Defense Physical Science and Technology Conference, New Orleans, LA, November. (Oral presentation)
- 70) Hu, L. B., Savidge, C. R., Brownell, M., Hayden, N. J., Rizzo, D., and Dewoolkar, M. M. (2008), "Prediction of agent transport in porous building materials", Chemical and Biological Defense Physical Science and Technology Conference, New Orleans, LA, November. (Oral presentation)
- 71) Hayden, N. J., Neumann, M., Rizzo, D. M., Dewoolkar, M. M., and Sadek, A. (2006), "Integrating Catamount community service-learning projects within civil and environmental engineering programs at the University of Vermont", *Conf. Proc. on Innovations in Engineering Education, ASEE, Worcester, MA, March*.
- 72) Dewoolkar, M. M., Ko, H. Y. and Sture, S. (1993), "Experimental results of Model No. 4b", *Proceedings of the International Conference on the Verification of Numerical Procedures for the Analysis of Soil Liquefaction Problems*, Vol. 1, Arulanandan & Scott (eds), October, 701-710.

Technical Reports

- 73) Gomez, B. W., Dewoolkar, M. M., and Lens, J. E. (2014), Verification of Abutment and Retaining Wall Design Assumptions, submitted to Vermont Agency of Transportation.
- 74) Lens, J. E., Dewoolkar, M. M., Springston, G. E., and Becker, L. R. (2013), Seismic Hazard for the Burlington and Colchester, Vermont USGS 7-1/2 Minute Quadrangles, report submitted to Vermont geological Survey, June 5.
- 75) Anderson, I. A., Suozzo, M., and Dewoolkar, M. M. (2012), *Laboratory and Field Evaluations of Pervious Concrete*, submitted to Vermont Agency of Transportation and UVM Transportation Research Center.
- 76) Dewoolkar, M., Anderson, I., de Alba, P., and Hargy, J. (2010), *Measurement of the Strength of Liquefied Soil in Physical Models*, submitted to the National Science Foundation.
- 77) Dewoolkar, M. M., Hayden, N. J., Rizzo, D. M., Hu, L. B., and Savidge, C. R. (2010), *Prediction of Agent Fate in Porous Building Materials*, submitted to the Defense Threat Reduction Agency, p.164.
- 78) McCain, G., and Dewoolkar, M. M. (2009), *An Investigation into Porous Concrete Pavements for Northern Communities*, submitted to Vermont Agency of Transportation.
- 79) Dewoolkar, M. M., Borg, J., and Bierman, P. (2008), *Evaluating Quantitative Models of Riverbank Stability*, submitted to Vermont Agency of Natural Resources.
- 80) Yang, D., R. Currier, M. Dewoolkar, and D. Porter (2007), *Fundamentals of Agent Fate*, prepared for the Department of Homeland Security, March.

- 81) Brownell, M., M. M. Dewoolkar, N. J. Hayden, D. Rizzo, and D. Porter (2006), *Interactions of Contaminating Agents with Historic and Common Building Materials*, report submitted to Los Alamos National Laboratory, October.
- 82) Ashworth, L., Dewoolkar, M., Wei, C., Porter, D., Visser, T., and Williams, R. (2005), *Chemical and Biological Contaminants and the Transport Properties of Historic Building Materials*, submitted to Los Alamos National Laboratory, April.
- 83) Geotechnical Report for Lake Gulch Interceptor Sewer and Sellers Gulch Lift Station Project, GEI Consultants, Inc., submitted to CH2MHILL, April 2003.
- 84) Project Definition and Design Criteria for Highway 93 Dam and Reservoir Project, GEI Consultants, Inc., submitted to City of Arvada, Colorado, March 2003.
- 85) Rueter-Hess Dam Embankment Design Technical Memorandum, GEI Consultants, Inc., submitted to Parker Water and Sanitation District, Parker, Colorado, December 2002.
- 86) Rueter-Hess Dam and Reservoir Project Outlet Works/Service Spillway Design Technical Memorandum, GEI Consultants, Inc., submitted to Parker Water and Sanitation District, Parker, Colorado, December 2002.
- 87) Engineering Analysis and Design of a Relief Well System for North Lake Dam, GEI Consultants, Inc., submitted to the City of Trinidad, October 2002.
- 88) Geotechnical Evaluation of Mine-Induced Seismicity on Bruce Park Dam, Delta County, Colorado, GEI Consultants, Inc., submitted to Bowie Resources, Ltd., September 2002.
- 89) Geotechnical Report for Fulton Ditch Lining Project, GEI Consultants, Inc., submitted to Muller Engineering Company, Lakewood, Colorado, August 2002.
- 90) Rueter-Hess Dam Geotechnical and Geological Data Report, GEI Consultants, Inc., submitted to Parker Water and Sanitation District, Parker, Colorado, January 2002.
- 91) Design Criteria Technical Memorandum Rueter-Hess Dam and Reservoir Project, GEI Consultants, Inc., submitted to Parker Water and Sanitation District, CO, February 2002.
- 92) Rueter-Hess Dam Claystone Bedrock Foundation Strength, GEI Consultants, Inc., submitted to Parker Water and Sanitation District, Parker, Colorado, December 2001.
- 93) Geotechnical Engineering Services for O'Brian Canal Project, GEI Consultants, Inc., submitted to Muller Engineering Company, Inc., Lakewood, Colorado, November 2001.
- 94) Stability Investigation McKay lake Dam Renovation Project, GEI Consultants, Inc., submitted to City of Westminster, Colorado, August 2001.
- 95) Soil-Bentonite Cutoff Wall Feasibility Study for the Hazeltine/Road Runners Rest II Gravel Pits, GEI Consultants, Inc., submitted to Denver Water, July 2001.
- 96) Geotechnical Data and Embankment Stability Standley Lake Dam Renovation Project, GEI Consultants, Inc., submitted to Farmers Reservoir and Irrigation Company, CO, May 2001.
- 97) Geotechnical Report on Seepage and Stability Evaluation for the North Platte Supply Canal, GEI Consultants, Inc., submitted to Nebraska Public Power District, April 2001.
- 98) Effects of Sinkholes on Earth Embankments, University of Colorado at Boulder, submitted to the US Bureau of Reclamation, August 1999.
- 99) Centrifuge Modeling of a Gravity Based Structure under Static and Dynamic Loading Conditions, University of Colorado at Boulder, submitted to Exxon Production Research Company, October 1998.
- 100) Multiaxial Cubical Cell Apparatus for Testing Cohesive and Cohesionless Soils, University of Colorado at Boulder, submitted to Louisiana State University, November 1997.

- 101) Dynamic Centrifuge Model Testing of Bradbury Dam Spillway Retaining Wall, University of Colorado at Boulder, submitted to the US Bureau of Reclamation, November 1994.

SELECT RESEARCH GRANTS

- 1) MRI – Acquisition of a High Energy X-ray Tomography Scanner, National Science Foundation, \$276,793, PI, 2014-15.
- 2) Quantifying the Vulnerability of Vermont Bridges to Seismic Loading, Vermont Agency of Transportation (VTrans), \$214,150, PI, 2013-16.
- 3) Design of a “Smart-Structure” Deployable Airlock, NASA (eXploration Habitat [X-hab] Academic Innovation Challenge Program), \$10,000, Co-PI, 2014-15.
- 4) X-ray Tomography of Porous Materials, Defense Science and Technology Laboratory, U.K., \$114,311, PI, 2013.
- 5) GOALI/Collaborative Research: Passive, Diamagnetic Inertial Sensing Integrated with High-Sensitivity Telemetry, National Science Foundation, \$135,999, Co-PI, 2009-12.
- 6) NEESR Payload: Measurement of the Strength of Liquefied Soil in Physical Models, National Science Foundation, \$131,897, PI, 2007-09.
- 7) Reliable and Rapid Prediction of Agent Fate and Transport in Porous Materials, Defense Threat Reduction Agency, \$524,570, PI, 2008-10.
- 8) Studies to Characterize Interactions between Common Building Materials and Chemical Contaminants, Los Alamos National Laboratory, \$35,930, PI, 2006.
- 9) A Systems Approach to Civil and Environmental Engineering Education: Integrating Systems Thinking, Inquiry-Based Learning and Catamount Community Service-Learning Projects, National Science Foundation, \$860,000, Co-PI, 2005-2009.
- 10) Historic Preservation Engineering: Curriculum Development, National Center for Preservation Technology and Training, \$49,835, Co-PI, 2007-09.
- 11) Prediction and Mitigation of Scour for Vermont Bridges, Vermont Agency of Transportation (VTrans) and UVM Transportation Research Center (TRC), \$310,478, PI, 2012-16.
- 12) Porous Concrete – Chloride Resistance and Freeze/Thaw Durability, Vermont Agency of Transportation (VTrans) and UVM Transportation Research Center (TRC), \$97,659, PI, 2011-13.
- 13) Site Class, Amplification and Liquefaction Hazard for Burlington and Colchester 7.5-minute Quadrangles, Vermont, Vermont Agency of Natural Resources, \$45,071, PI, 2010-11.
- 14) Use of Piles in Slope Stabilization, Vermont Agency of Transportation (VTrans), \$50,000, PI, 2011-13.
- 15) Verification of Abutment and Retaining Wall Design Assumptions, Vermont Agency of Transportation (VTrans), \$45,392, PI, 2011-13.
- 16) Correlating Laboratory Behavior of Porous Concrete to Field Performance, Vermont Agency of Transportation (VTrans), \$59,913, PI, 2010-12.
- 17) Designing Sustainable Porous Pavements for Northern Communities, UVM Transportation Research Center (TRC) and Vermont Agency of Transportation (VTrans), \$124,983, PI, 2008-09.

INDUSTRY EXPERIENCE

As Geotechnical Engineer/Project Manager, was responsible for over a dozen projects involving analysis, design, and retrofitting of dams and reservoirs, lined water storage facilities, and canals. Descriptions of selected projects are as follows:

- Design of a 140 ft high earth dam for Parker Water and Sanitation District, Parker, Colorado: Field investigation, laboratory program, residual shear strength of claystone foundation bedrock, slope stability analysis, seepage analysis, drainage system design, liquefaction potential analysis, settlement analysis using conventional and finite element (program PLAXIS) methods, permanent seismic deformation analysis using empirical methods, SHAKE analysis and PLAXIS, static and seismic analyses of outlet works tower and conduits embedded in the u/s slope using PLAXIS.
- Determination of strength of about 75 ft thick alluvium in the foundation of a 230 ft high existing dam to evaluate seismic stability (name of the project to remain confidential): Coordinated, supervised and analyzed field investigation program. Investigation included BPT, SPT, and SASW shear wave velocity measurements. Hammer efficiency measurements were made for BPT and SPT measurements. Liquefaction potential analysis was conducted. Undrained steady state strength of the alluvium was estimated to evaluate post-earthquake stability of the dam.
- Evaluation of effects of mine-induced seismicity on Bruce Park Dam and adjacent existing landslide, Trinidad, Colorado: Back analysis of the existing landslide near the dam abutment. Material properties determination from field and laboratory investigation. Determination of the magnitude and nature of expected mine-induced seismic activity. SHAKE analysis. Estimated permanent deformations of the dam and landslide.
- Design of a relief well system to reduce pressures in the foundation of 70 ft high North Lake Dam, Trinidad, Colorado: A highly weathered and fractured layer of bedrock exists in the dam foundation underneath about 40 feet thick clayey alluvium. The layer is hydraulically connected to the reservoir. Piezometric heads in this layer at the d/s toe and below the crest of the dam were up to 30 feet higher than the d/s toe elevation. FOS against critical gradient, toe upheaval (blowout), and d/s slope stability are unacceptable. Seepage analysis of the dam was conducted for existing and with relief wells conditions. The model for the existing conditions was compared with measured seepage. As a remediation, a relief well system was designed.



State of Vermont

ANR Office of Planning & Legal Affairs

1 National Life Drive, Davis 2

Montpelier, VT 05620-3901

[phone] 802-595-2585

Agency of Natural Resources

June 12, 2015

Timothy A. Ngau, Esq.
Associate General Counsel
Nuclear Entergy Services, Inc.
1340 Echelon Parkway
Jackson, MS 39213

Re: PSB Docket No. 8300

Petition of Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. for a Certificate of Public Good, pursuant to 30 V.S.A. § 248 and 10 V.S.A. § 6522, authorizing the construction of a second independent spent fuel storage installation storage pad and related improvements, including installation of a new diesel generator with an electrical rating of approximately 200 kW, at the Vermont Yankee Nuclear Power Station in the Town of Vernon, Vermont.

Dear Mr. Ngau:

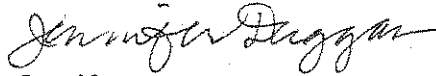
Pursuant to 30 V.S.A. § 20, please be advised that the Vermont Agency of Natural Resources seeks to allocate to Petitioner the costs and expenses associated with retaining Dr. Dewookar as an expert witness in the above-captioned matter.

The statute provides that the Agency of Natural Resources "may authorize or retain . . . expert witnesses, advisors, temporary employees, other research, scientific or engineering services to: (A) assist the Agency of Natural Resources in any proceeding under section 248 of this title." 30 V.S.A. § 20(a) (2) (A). Dr. Dewookar is an Associate Professor and heads the Civil & Environmental Program at the UVM School of Engineering. Dr. Dewookar is familiar with the Entergy Vermont Yankee site and provided expert testimony in connection with the first Entergy ISFSI docket.

Dr. Dewookar will charge \$200.00 an hour for his services. The services are estimated to cost no more than \$20,000. If it becomes necessary to exceed this amount, the Agency will notify Entergy.

Please contact me if you have any questions or require additional information. Thank you for your assistance with this matter.

Sincerely,

A handwritten signature in cursive script, appearing to read "Jennifer Duggan".

Jennifer S. Duggan
General Counsel

CC: Nancy S. Malmquist
Matthew Byrne
Leslie A. Cadwell



State of Vermont

ANR Office of Planning & Legal Affairs

1 National Life Drive, Davis 2

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[phone] 802-595-2585

Agency of Natural Resources

May 1, 2015

Timothy A. Ngau, Esq.
Associate General Counsel
Nuclear Entergy Services, Inc.
1340 Echelon Parkway
Jackson, MS 39213

Re: PSB Docket No. 8300

Petition of Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. for a Certificate of Public Good, pursuant to 30 V.S.A. § 248 and 10 V.S.A. § 6522, authorizing the construction of a second independent spent fuel storage installation storage pad and related improvements, including installation of a new diesel generator with an electrical rating of approximately 200 kW, at the Vermont Yankee Nuclear Power Station in the Town of Vernon, Vermont.

Dear Mr. Ngau:

As I had indicated to Attorney Nancy Malmquist, the Vermont Agency of Natural Resources intends to avail itself of the bill back provision of 30 V.S.A. § 21, for the work associated with the Vermont Public Service Board Docket # 8300. This letter serves as the official notice of our intent.

Accordingly, pursuant to 30 V.S.A. § 21, please be advised that the Vermont Agency of Natural Resources ("ANR") intends to allocate to Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (together "Entergy VY"), the portion of costs and expenses of ANR employees for their work related to the proceedings in Public Service Board Docket # 8300.

The relevant statute, 30 V.S.A. § 21 (b), provides in pertinent part:

When regular employees of the board, the department, or the agency of natural resources are employed in the particular proceedings described in section 20 of this title, [which include petitions for a certificate of public good] the board, the department, or the agency of natural resources may allocate the portion of their costs and expenses to the applicant or the public service company or companies involved in the proceedings.

ANR may allocate expenses under 30 V.S.A. § 21, only for costs in excess of \$3,000. ANR expects to exceed this minimum threshold in connection with its work in the Public Service Board, Docket # 8300.

From time to time, ANR will provide Entergy VY with a statement showing the amount of money expended for the work of ANR employees in connection with the Public Service Board proceeding for Docket # 8300. We can discuss the frequency of such statements and any other issue raised by this notice at your convenience.

Under 30 V.S.A. § 21, Entergy VY may petition the Public Service Board to review the costs allocated to Entergy VY.

Please contact me if you have any questions.

Sincerely,



Judith L. Dillon
Senior Legal Counsel

Cc Nancy S. Malmquist, Esq.
Matthew B. Byrne, Esq.
Leslie A. Cadwell, Esq.