

## Avner Vengosh

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### EDUCATION

AUSTRALIAN NATIONAL UNIVERSITY, RESEARCH SCHOOL OF EARTH SCIENCE  
Canberra, Australia

- Ph.D., 1990, Environmental Geochemistry (Thesis title: *Boron isotope geochemistry in the sedimentary environment*).

Advisor: Professor Allan Chivas and Professor Malcolm McCulloch.

HEBREW UNIVERSITY OF JERUSALEM, Jerusalem, Israel

- M.Sc., 1986, Isotope Geology (Thesis title: *Stable isotopes in coexisting phases of phosphatic, carbonate and siliceous rocks of the Mishash Formation, Israel*).

Advisor: Professor Yehushua Kolodny.

HEBREW UNIVERSITY OF JERUSALEM, Jerusalem, Israel

- B.Sc., 1984.

### ACADEMIC APPOINTMENTS

DUKE UNIVERSITY, Durham, NC, USA

NICHOLAS SCHOOL OF ENVIRONMENT, DIVISION OF EARTH AND OCEAN  
SCIENCES,

2010- *Professor (tenured)*

DUKE UNIVERSITY, Durham, NC, USA

NICHOLAS SCHOOL OF ENVIRONMENT, DIVISION OF EARTH AND OCEAN  
SCIENCES,

2005 -2010 *Associate Professor (tenured)*

DUKE UNIVERSITY, Durham, NC, USA

PRATT SCHOOL OF ENGINEERING, DEPARTMENT OF CIVIL AND ENVIRONMENTAL  
ENGINEERING,

2009 - *Secondary Appointment as an Associate Professor*

STANFORD UNIVERSITY, Stanford, California, USA,

DEPARTMENT OF GEOLOGICAL AND ENVIRONMENTAL SCIENCES

August 2003 – March 2004, *Visiting Professor (sabbatical leave)*

BEN GURION UNIVERSITY, Beer Sheva, Israel,

DEPARTMENT OF GEOLOGICAL AND ENVIRONMENTAL SCIENCES

1999 -2005 (since 2002 tenured position), *Associate Professor*

UNIVERSITY OF CALIFORNIA SANTA CRUZ, Santa Cruz, California, USA,  
INSTITUTE OF EARTH AND MARINE SCIENCES  
1996-1997, *Visiting Scientist (sabbatical leave)*

HYDROLOGICAL SERVICE, Jerusalem, Israel  
RESEARCH DEPARTMENT  
1991-1999, *Senior Lecturer*

#### **AFFILIATIONS & MEMBERSHIPS**

Geochemical Society, American Geophysical Union (AGU), Geological Society of America (GSA).

#### **PROFESSIONAL SERVICE**

Reviewer for numerous articles in *Environmental Science and Technology*, *Geochimica Cosmochimica Acta*, *Chemical Geology*, *Applied Geochemistry*, *Journal of Hydrology*, *Water Research*, *Water Quality Research of Canada*, *Aquatic Geochemistry*, *Hydrogeology Journal*, *The Science of Total Environment*, *Journal Environmental Quality*.

Reviewer for numerous NSF grants.

- 2009            A testimony to the Subcommittee on Water Resources and Environment, U.S. House of Representatives; "*The Tennessee Valley Authority's Kingston Ash Slide: Potential Water Quality Impacts of Coal Combustion Waste Storage*". Washington, DC, March 31, 2009.
- 2008            Keynote speaker at University Council on Water Resources/ National Institute for Water Research annual conference "International water resources: Challenges for the 21<sup>st</sup> century", Durham, NC, July 2008.
- 2007            Chair of a special session (Pardee Keynote Symposia) of the Geological Society of America, entitled "*Middle Eastern Water Resources in Times of Crisis*", 2007 GSA Annual Meeting & Exposition, Denver, October 28-31, 2007.
- 2007-present   **Associate Editor** of the international journal *Applied Geochemistry*.
- 2007            Chair of a session entitled "*Natural Contaminants in Groundwater Resources: Occurrence, Geochemistry, Health, and Remediation*", American Geophysical Union (AGU), Joint Assembly Meeting, Acapulco, Mexico, May 22-25, 2007.
- 2007- present   Member of the Environmental Surveillance Committee of the N.C. Radiation Protection Commission.
- 2006-2009      Principle Investigator of a USDA research project entitled "*An integrative investigation of the sources and effects of groundwater contamination for local communities and homeowners in North Carolina*".

- 2006-2009 Investigator of a USAID (MERC) research project entitled “*The salinity curse of the Middle East fossil groundwater: The Radioactivity factor*”.
- 2006 Chair of a Workshop on “*Radon Occurrence, Health Risks and Policy, with an Emphasis on Radon in Ground Water Drinking Supplies*”, Duke University, Durham, NC, (<http://www.nicholas.duke.edu/radon/>), October 4, 2006.
- 2003 Advisor to International Atomic Energy Agency for designing Cooperation Research Project on application of isotopes in studying agricultural return flow.
- 2003 - 2004 Vice-President, International Commission on Water Quality, International Association of Hydrological Sciences.
- 2001-2005 **Associate Editor** for the international journal *Water Resources Research*.
- 2001-2004 Coordinator of the geochemistry research group of European Union Fifth Framework research BOREMED entitled “*Boron contamination of Water resources in the Mediterranean region: Distribution, Sources, Social impact and Remediation*”.
- June 2001 Invited Speaker at *Water-Rock Interaction –10* International conference, Sardinia, Italy.
- 1999-2004 Coordinator of US-AID - Middle East Regional Cooperation Research (MERC) project entitled “*Water Quality along the Jordan River and evaluation of the sources of salts*”.
- 2000 Organizer of a special workshop with the International Atomic Energy Agency, entitled “*Regional workshop on isotopes and geochemical methods in the study of water and salinization in arid region.*”
- 1999 Advisor for the design of Cooperation Research Project on application of isotopes in studying salinization, International Atomic Energy Agency, Vienna, Austria.

### **Duke University service**

- 2007- present **Chair of Water and Air Resources Program** at the Nicholas School of Environment and Earth Sciences, Duke University.

Member of Duke University Radioactivity Safety Committee, University Calendar Committee, Academic Council (2006-2008), Nicholas School of Environment Water Initiative Committee, and head of Search Committee for a Global Hydrology position.

## PUBLICATIONS

*(in bold, research done while Vengosh's graduate students)*

### Refereed articles in scientific journals

#### *Articles submitted*

Osborn, S., Vengosh, A. Warner, N. Jackson, R. (submitted). Methane contamination of drinking water accompanying gas drilling and hydro-fracking. Submitted to *Proceedings of the National Academy of Sciences*.

#### *Articles published after appointment at Duke*

53) **Vinson, D., Schwartz, H.,** Dwyer, G., Vengosh, A. (2010). Evaluating salinity sources of groundwater and implications for sustainable reverse osmosis desalination in coastal North Carolina, USA. *Hydrogeology Journal* (provisionaaly accepted).

52) **Ruhl, L., Vengosh, A.,** Dwyer, G.S., Hsu-Kim, H., **Deonarine,** (2010). The Environmental Impacts of the Coal Ash Spill in Kingston, Tennessee: An Eighteen-Month Survey. *Environmental Science and Technology*, 44, 9272–9278.

51) Sowers. J. Vengosh, A., Weinthal, E.S. (2010) Climate change, water resources, and the politics of adaptation in the Middle East and North Africa. *Climatic Change* (DOI 10.1007/s10584-010-9835-4) .

50) Pratson, E., Vengosh, A., Dwyer, G., Pratson, L. and Klein, E. (2010). The Effectiveness of Arsenic Remediation from Groundwater in a Private Home. *Ground Water Monitoring and Remediation*, 30, 87-93.

49) Bouchaou, L. , Qurtobi, M., Michelot , J.L., Zine, N., Gaye, C.B., Aggarwal, P.K., Mara, H., Zerouall, A., Taleb, H. and Vengosh, A. (2009). Origin and residence time of groundwater in the Tadla basin (Morocco)next term using multiple isotopic and geochemical tools. *Journal of Hydrology*, 379, 323-338.

48) **Ruhl, L., Vengosh, A.,** Dwyer, G.S., Hsu-Kim, H., Deonarine, A., Bergin, M., Kravchenko, J. (2009). Survey of the potential environmental and health impacts in the immediate aftermath of the coal ash spill in Kingston, Tennessee. *Environmental Science and Technology*, 43, 6326–6333.

47) Vengosh, A., Hirschfeld, D., Vinson, D.S., Dwyer, G.S. **Raanan, H.,** Rimawi, O., Al-Zoubi, A., Akkawi, E., Marie, A., Haquin, G., Zaarur, S., and Ganor, J. (2009) High Naturally Occurring Radioactivity in Fossil Groundwater in the Middle East. *Environmental Science and Technology*, 43 (6), 1769-1775• DOI: 10.1021/es802969r.

46) **Vinson, D.S., Vengosh, A., Hirschfeld, D.** and Dwyer, G.S. (2009). Relationships between radium and radon occurrence and hydrochemistry in fresh groundwater from fractured crystalline rocks, North Carolina (USA). *Chemical Geology*, 260, 159-171.  
doi:10.1016/j.chemgeo.2008.10.022.

- 45) **Raanan, H., Vengosh, A.,** Paytan, A., and Nishri, A. (2009) Quantifying saline groundwater flow into a fresh water lake using the Ra isotope quartet: A case study from the Sea of Galilee (Lake Kinneret), Israel. *Limnology and Oceanography*, 54(1), 119–131.
- 44) **Vinson, D.S.,** Campbell, T.R. and **Vengosh, A.** (2008). Radon-222 transfer from groundwater used in showers to indoor air. *Applied Geochemistry*, 23, 2676-2685.
- 43) Kloppmann, W., **Vengosh, A.,** Guerrot, K., Millot, R., and Parnkaratov, I. (2008) Isotope and ion selectivity in reverse osmosis desalination: Geochemical tracers for man-made freshwater. *Environmental Science and Technology*, 42 (13), 4723–4731, 10.1021/es7028894.
- 42) Bouchaou, L. , Michelot J.L., **Vengosh, A.,** Hsissou, Y. , Qurtobi, M. , Gaye, C.B. , Bullen, T.D. and Zuppi, G.M. (2008). Application of multiple isotopic and geochemical tracers for investigation of recharge, salinization, and residence time of water in the Souss-Massa aquifer, Southwest of Morocco. *Journal of Hydrology*, 352, 267-287.
- 41) **Vengosh, A., Hening, S.,** Ganor, J., Mayer, B., Weyhenmeyer, C.E., Bullen. T.D. , and Paytan, A. (2007). New isotopic evidence for the origin of groundwater from the Nubian Sandstone Aquifer in the Negev, Israel. *Applied Geochemistry*, 22, 1052-1073.
- 40) **Farber, E., Vengosh, A.,** Gavrieli, I., Marie, A., Bullen, T.D., Mayer, B., Polak, A., and Shavit, U. (2007). The geochemistry of groundwater resources in the Jordan Valley: impact of the Rift Valley brines. *Applied Geochemistry*, 22, 494-514.
- 39) **Vengosh, A.** (2006) Rooting Out Radioactive Groundwater. *Geotimes*, May 2006, 18-21.
- Work published prior appointment at Duke*
- 38) Weinthal, E., **Vengosh, A.** Marie, A., Gutierrez A, Kloppmann, W. (2005) The Water Crisis in the Gaza Strip: Prospects for remediation. *Ground Water*, 43, 653-660.
- 37) **Farber, E., Vengosh, A.,** Gavrieli, I., Marie, A., Bullen, T.D., Mayer, B., Holtzman, R., Segal, M. and Shavit, U. (2005) Management scenarios for the Jordan River salinity crisis. *Applied Geochemistry*, 20, 2138-2153.
- 36) Weinthal., E., Parag, Y., **Vengosh, A.,** Muti, A., Kloppmann, W. (2005) The EU drinking water directive: The boron standard and scientific uncertainty. *European Environment*, 15, 1-12.
- 35) **Holtzman, R.,** Shavit, U., **Segal-Rozenhaimer, M.,** Gavrieli, I., Marie, A., **Farber, E., Vengosh, A.** (2005) Quantifying groundwater inputs along the Lower Jordan River. *Journal of Environmental Quality*, 34, 897-906.
- 34) **Vengosh, A.,** Kloppmann, W., Marie, A., Livshitz, Y., Gutierrez, A., Banna, M., Guerrot, C., Pankratov, I., **Ranan, H.,** (2005). Sources of salinity and boron in the Gaza Strip: Natural contaminant flow in the southern Mediterranean Coastal aquifer. *Water Resources Research*, 41, W01013, doi:10.1029/2004WR003344.

- 33) **Kass, A.**, Gavrieli, I., Yechieli, Y., Vengosh, A. and Starinsky, A. (2005) The impact of freshwater and wastewater irrigation on the chemistry of shallow groundwater: a case study from the Israeli Coastal Aquifer. *Journal of Hydrology*, 300, 314-331.
- 32) **Segal-Rozenhaimer, M.**, Shavit, U., Vengosh, A., Gavrieli, I., **Farber, E.**, **Holtzman, R.**, Mayer, B. and Shavit, A. (2004). Sources and Transformations of Nitrogen Compounds along the Lower Jordan River. *Journal of Environmental Quality*, 33, 1440-1451.
- 31) **Farber, E.**, Vengosh, A., Gavrieli, I., Marie, A., Bullen, T.D., Mayer, B., **Holtzman, R.**, **Segal, M.**, and Shavit, U. (2004) The origin and mechanisms of salinization of the Lower Jordan River. *Geochimica Cosmochimica Acta*, 68, 1989-2006.
- 30) Polat, A., Vengosh, A., Pankratov, I. And Polat, M. (2004) A new methodology for removal of boron from water by coal and fly ash. *Desalination*, 164, 173-188..
- 29) Vengosh, A., Weinthal, E., Kloppmann W. and BOREMED team (2004) Natural boron contamination in Mediterranean groundwater. *Geotimes*, 49, 20-25, May 2004.
- 28) Vengosh, A., Gill, J., Davisson, M.L., and Huddon, G.B., (2002). A multi isotope (B, Sr, O, H, C) and age dating ( $^3\text{H}$ - $^3\text{He}$ ,  $^{14}\text{C}$ ) study of groundwater from Salinas Valley, California: Hydrochemistry, dynamics, and contamination processes. *Water Resources Research*, 38, 9-1-17.
- 27) Vengosh, A., Helvacı, C. and Karamanderesi, I.H. (2002). Geochemical constraints for the origin of thermal waters from western Turkey. *Applied Geochemistry* 17, 163-183.
- 26) Yechieli, Y., Sivan, O., Lazar, B., Vengosh, A., Ronen, D., and Herut, B. (2001).  $^{14}\text{C}$  in seawater intruding into the Israeli Mediterranean coastal aquifer. *Radiocarbon*, 43 (no. 2B), 773-781.
- 25) Marie, A. and Vengosh, A. (2001). Sources of salinity in groundwater from Jericho area, Jordan valley. *GroundWater*, 39, 240-248.
- 24) Vengosh, A. and Hendry, M.J. (2001). Chloride-bromide- $\delta^{11}\text{B}$  systematics of a thick clay-rich aquitard system. *Water Resources Research*, 37, 1437-1444.
- 23) Vengosh, A., Barth, S., Heumann, K.G., and Eisenhut, S. (1999). Boron isotopic composition of fresh water lakes from Central Europe and possible contamination sources. *Acta hydrochimica et hydrobiologica*, 27, 416-421.
- 22) Vengosh, A., Gieskes, J., and Mahn, C. (1999). New evidence for the origin of hypersaline pore fluids in the Mediterranean Basin. *Chemical Geology*, 163, 287-298.
- 21) Vengosh, A., Spivack, A.J., **Artzi, Y.**, and Ayalon, A. (1999). Boron, strontium, and oxygen isotopic and geochemical constraints for the origin of salinity in groundwater from the Mediterranean coast of Israel. *Water Resources Research*, 35, 1877-1894.
- 20) Vengosh, A. (1998). The isotopic composition of anthropogenic boron and its potential impact on the environment. *Biological Trace Element Research*, 66, 145-151.

19) Vengosh, A., De Lange, G.J., Starinsky A. (1998). Boron isotope and geochemical evidence for the origin of Urania and Bannock brines at the eastern Mediterranean: Effect of water-rock interactions. *Geochimica Cosmochimica Acta*. 62, 3221-3228.

18) Vengosh, A. and Pankratov I. (1998). Chloride/bromide and chloride fluoride ratios of domestic sewage effluents and associated contaminated ground water. *Ground Water*, 36, 815-824.

17) Eisenhut S., Heumann, K.G. and Vengosh, A. (1996). Determination of boron isotopic variations in aquatic systems with negative thermal ionization mass spectrometry as a tracer for anthropogenic influences. *Fresenius Journal of Analytical Chemistry* , 354, 903-909.

16) Vengosh, A. and Keren R. (1996). Chemical modifications of groundwater contaminated by recharge of sewage effluent. *Journal of Contaminant Hydrology* , 23, 347-360.

15) Vengosh, A., Chivas, A.R., Starinsky, A. and Kolodny, Y. (1995). Boron isotope geochemistry of non-marine brines from the Qaidam Basin (China). *Chemical Geology*, 120, 135-154.

14) Heumann, K.G., Eisenhut S., Gallus S., Hebeda E.H., Nusko R., Vengosh, A. and Walczyk T. (1995). Recent developments in thermal ionization mass spectrometric techniques for isotope analysis; A review. *Analyst*, 120, 1291-1299.

13) Vengosh, A. and Rosenthal, A. (1994). Saline groundwater in Israel: Its bearing on the water crisis in the country. *Journal of Hydrology* , 156; 389-430.

12) Vengosh, A., Starinsky, A., and Anaty, D. (1994). The origin of hypersaline interstitial waters in the Mediterranean Basin - relics of ancient Miocene brines: A reevaluation. *Earth and Planetary Science Letters*, 121; 613-627.

11) Vengosh, A. and Ben Zvi, A. (1994). Formation of a salt plume in the Coastal Plain Aquifer of Israel: The Be'er Toviyya region. *Journal of Hydrology*, 160; 21-52.

10) Vengosh, A., Starinsky A., Kolodny, Y. and Chivas, A.R. (1994). Boron isotope geochemistry of thermal springs from the Northern Rift Valley, Israel. *Journal of Hydrology*, 162, 155-169.

9) Vengosh, A., Heumann, K.G., Juraske, S., and Kasher R. (1994). Boron isotope application for tracing sources of contamination in groundwater. *Environmental Science & Technology*, 28; 1968-1974.

8) Vengosh, A., Starinsky, A. and Chivas, A.R., (1994). Boron isotopes in Heletz-Kokhav oilfield brines, the Coastal Plain, Israel. *Israel Journal of Earth Sciences*, 43, 231-237.

7) Vengosh, A. and Starinsky, A. (1993). Relics of evaporated sea water in deep basins of the Eastern Mediterranean. *Marine Geology*, 115; 15-19.

6) Vengosh, A., Starinsky, A., Kolodny, Y., Chivas, A.R. and Raab M. (1992). Boron isotope variations during fractional evaporation of sea water: New constraints on the marine vs. nonmarine debate. *Geology*, 20; 799-802.

- 5) Vengosh, A., Starinsky, A., Kolodny, Y. and Chivas, A.R. (1991). Boron-isotope geochemistry as a tracer for the evolution of brines and associated hot springs from the Dead Sea, Israel. *Geochimica Cosmochimica Acta*, 55; 1689-1695.
- 4) Vengosh, A., Chivas, A.R., McCulloch, M.T., Starinsky, A. and Kolodny, Y. (1991). .E., Boron-isotope geochemistry of Australian salt lakes. *Geochimica Cosmochimica Acta*, 55; 2591-2606.
- 3) Vengosh, A., Kolodny, Y., Starinsky, A., Chivas, A.R. and McCulloch, M.T. (1991). Coprecipitation and isotopic fractionation of boron in modern biogenic carbonates. *Geochimica Cosmochimica Acta*, 55; 2901-2910.
- 2) Vengosh, A., Chivas, A.R. and McCulloch, M.T (1989). Direct determination of boron and chlorine isotopes in geological materials by negative thermal-ionization mass spectrometry. *Chemical Geology (Isotope Geoscience Section)*, 79; 333-343.
- 1) Vengosh, A., Kolodny, Y. and Tepperberg, M. (1987). Multi-phase oxygen isotopic analysis as a tracer of diagenesis: the example of the Mishash Formation, Cretaceous of Israel. *Chemical Geology (Isotope Geoscience Section)*, 65; 235-253.

### Refereed chapters in books

- 4) Vengosh, A. (2003). *Salinization and Saline Environments*. In: Sherwood Lollar, B. (ed.), *Environmental geochemistry (volume 9), Treatise in Geochemistry*. Executive Editors: Holland, H.D. and Turekian, K.T., Elsevier Science (<http://www.TreatiseOnGeochemistry.com>).
- 3) Shavit, U., **R. Holtzman, M. Segal, Vengosh, A.** E. Farber, I. Gavrieli, T. Bullen, and ECO-Research Team (2002). *Water Sources and Quality Along the Lower Jordan River, Regional Study*, In *Water Resources Quality, Preserving the Quality of our Water Resources*, Edited by H. Rubin, H.P. Nachtnebel, J. Furst, and U. Shamir, Springer-Verlag, Berlin, pp. 127-148, 2002.
- 2) Vengosh, A. and A.J. Spivack (2000). *Boron in Ground Water*. In: P. Cook and A. Herczeg (eds.), *Environmental Tracers in Groundwater Hydrology*, Kluwer Publisher, Boston, Dordrecht, London (pp. 479-485).
- 1) Jones B.F., Vengosh, A., Rosenthal, E., and Yechieli, Y. (1999). *Chapter 3: Geochemical Investigations*. In: Bear J., Cheng A.H.D., Sorek S., Ouazar, D., and Herrera, I. (eds.), *Seawater Intrusion in Coastal Aquifers - Concepts, Methods and Practises*. Kluwer Academic Publishers, Dordrecht, The Netherlands. pp. 51-72.

### Articles in proceedings

**Warner, N.**, Lgourna, Z., Boutaleb, S., Tagma, T., Vinson, D. S., Ettayfi, N., Bouchaou, L., Vengosh, A., 2010. A geochemical approach for the evaluation of water availability and salinity in closed basins: the Draa Basin, Morocco. American Geophysical Union, Fall Meeting 2010, San Fransisco.



Lyons, W.B., **Warner, N., Leslie, D.,** Welch, K., Bullen, T.M., Vengosh, A. 2010. The use of multiple stable isotopes in discern solute sources and geochemical process in Anartartic lakes. Geological Society of America, Denver, CO, 31 October –3 November 2010.

**Vinson, D.,** Lundy, J. Vengosh, A. (2010) Radium in the Jordan sandstone aquifer (Minnesota): New insights from isotopic measurements of groundwater and aquifer solids. Geological Society of America, Denver, CO, 31 October –3 November 2010.

**Leslie D, Warner N,** Vengosh A, Olesik J, Welch K & Lyons WB., 2010. Boron Isotopic Geochemistry of the McMurdo Dry Valleys, Antarctica. 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Warner N, Nunnery A,** Dwyer G, Baker P, Fritz S & Vengosh A., 2010. Boron Isotopic Ratios from the Salar de Uyuni, Bolivian Altiplano as a Paleoenvironmental Indicator. 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Merola, R.B. &** Vengosh A., 2010. Low-Level Arsenic Contamination of Groundwater with Biomarker Monitoring in Union County, NC. 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Vinson, D.,** McIntosh, J. and Vengosh A., 2010. Sr Isotope Constraints on Natural Oxy-Anionic Contaminants in a Basin-Fill Aquifer (Arizona, USA). 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Ruhl, L.,** Vengosh, A. & Dwyer G, 2010. Isotopic and Geochemical Tracers for Evaluating the Environmental Impact of the Tennessee Valley Authority Coal Ash Spill in Kingston, TN. 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Deonarine, A.,** Hsu-Kim, H., Ruhl, L., Vengosh, A., 2010. Riverine mercury contamination after the 2008 coal ash spill at the Kingston Fossil Plant, TN. 20th Annual V.M. Goldschmidt Conference Knoxville, TN. June 21-25, 2010.

**Deonarine, A.,** Hsu-Kim, H., Ruhl, L., Vengosh, A. 2010. Assessment of mercury and methylmercury in the Emory, Clinch and Tennessee River system after the December 2008 coal ash spill at the Kingston Fossil Plant, TN. TVA-Kingston Fly Ash Release Environmental Research Symposium, March 11-12, 2010. Harriman, TN.

**Ruhl, L.,** Vengosh, A. & Dwyer G, 2010. Differential leaching of trace metals and their isotopes from coal combustion products. TVA-Kingston Fly Ash Release Environmental Research Symposium, March 11-12, 2010. Harriman, TN.

**Ruhl, L.,** Vengosh, A. & Dwyer G, 2010. The impact of the Tennessee Valley Authority (TVA) coal ash spill of the quality of the Emory and Clinch Rivers: the first year evaluation TVA-Kingston Fly Ash Release Environmental Research Symposium, March 11-12, 2010. Harriman, TN.

**Ruhl, L.,** Vengosh, A., Dwyer G, A. Deonarine; H. Hsu-Kim, 2009. Water quality monitoring of the Emory and Clinch River: the impact of the Tennessee Valley Authority coal ash spill, Kingston, TN. SETAC North America 30th Annual Meeting; Human-Environment Interactions: Understanding Change in Dynamic Systems; Hilton Riverside, New Orleans, Louisiana, USA, 19 - 23 November 2009.

**Raanan, H.** and Vengosh, A., 2009. Radium isotopes as natural tracers of groundwater seepage in low salinity systems. Geological Society of America, Portland, Oregon ; 18-21 October 2009; *GSA Abstracts with Programs*. Vol. 41, No. 7, p. 348.

**Nunnery, A.,** Warner, N., Baker, P., Dwyer, G.S., Vengosh, A. Fritz, S.C., Lowenstein, T.K., Godfrey, L. and Rigsby, C.A., 2009. Climate significance of large lakes on the Bolivian Altiplano of South America. Geological Society of America, Portland, Oregon ; 18-21 October 2009; *GSA Abstracts with Programs*. Vol. 41, No. 7, p. 274.

**Warner, N.,** Tagma, T., Bouchaou, L., Boutaleb, S., Lgourna, Z., Pankratove, I., Ettayfi, N., Hsissou, Y., Belkacim, S. and Vengosh, A. 2009. Investigation of groundwater chemistry of the western Atals and Ant-Atlas mountains in Morocco using boron, strontium, and radium isotopes. Geological Society of America, Portland, Oregon ; 18-21 October 2009; *GSA Abstracts with Programs*. Vol. 41, No. 7, p. 579.

**Vinson, D.S.** Lundt D.S., Vengosh, A., and Dywer, G.S., 2009. Radium in the Jordan sandstone, Minnesota: Distribution and geochemical controls in an aquifer recharged by meltwater. Geological Society of America, Portland, Oregon ;18-21 October 2009; *GSA Abstracts with Programs*, Vol. 41, No. 7, p. 700.

**Ruhl, L.,** Vengosh, A., and Dwyer, G.S., 2009. Boron and strontium isotope proxies for tracing the environmental impact of the TVA coal ash spill. Geological Society of America, Portland, Oregon; 18-21 October 2009; *GSA Abstracts with Programs*, Vol. 41, No. 7, p. 334.

Vengosh, A., **Ruhl, L.,** Dwyer, G.S., 2009. The isotopic imprint of coal ash impact on the environment. 8<sup>th</sup> International Symposium on Applied Isotope Geochemistry. La Malbaie, Quebec, Canada, August 30-September 4, 2009.

Vengosh, A., Dwyer, G.S., Rimawi, O., Al-Zoubi, A., Ganor, J., 2009. The origin of fossil groundwater from the Nubian sandstone aquifers in the Middle East: A multi-isotope (Ra, B, Sr, S, O, H) investigation. Goldschmidt Conference, Davos, Switzerland, June 21-26, 2009.

**Vinson, D.S.,** Lundy, J.R., Dwyer, G.S., Vengosh, A., 2009. Coupled use of Sr and Ra isotopes to assess Ra mobility and water-rock interaction in sandstone aquifers. Goldschmidt Conference, Davos, Switzerland, June 21-26, 2009.

Vengosh, A., **Ruhl, L.,** Dwyer, G., Hsu-Kim, H., Deonarine, A., Bergin, M., Kravchenko, J. (2009) The environmental and health effects of the coal ash spill at Kingston, Tennessee: Preliminary assessment. World of Coal ash 2009 (WOCA), Lexington, Kentucky, May 4-7, 2009.

Vengosh, A., **Vinson, S. Eigel, S. Merola, B.R.,** Pratson, E., Dwyer, G., Benneer, L.S., Klein, E., Tootoo, J., Weinthal, W.S., Wiesner, M. (2009) An integrative study of the sources and effects of

naturally occurring contaminants in private wells in North Carolina: A water quality prospective. USDA-CSREES 2009 National Water Quality Conference. St. Louis, MO. February 8-12, 2009.

Dwyer, G. S. and Vengosh, A. (2008) Alternative filament loading solution for accurate analysis of boron isotopes by negative thermal ionization mass spectrometry. American Geophysical Union, Fall Meeting 2008, abstract #H51C-0824.

Vengosh, A., **Hirschfeld, D., Vinson, D.S.**, Rimawi, O., Al Zoubi, A., Marie, A., Ganor, J. Dwyer, G. S. (2008) Isotopic Tracers (Ra, Sr, O, H) for Elucidating the Sources of High Naturally Occurring Radioactive Groundwater from the Disi Aquifer, Jordan. *GSA Abstracts with Programs*, GSA, Vol. 40, No. 6, p. 120.

**Raanan, H.**, Vengosh, A., Paytan, A., Nishri, A., and Kabala, Z. (2008) Ra Isotopes as a Tool for Quantifying Saline Groundwater Flow into a Fresh Water Lake. A Case Study from the Sea of Galilee (Lake Kinneret), Israel. *GSA Abstracts with Programs*, GSA, Vol. Vol. 40, No. 6, p. 346.

**Vinson, D.S.**, Lundy, J.R., Dwyer, G.S. and Vengosh, A. (2008) Isotopic Indicators ( $^{223}\text{Ra}$ ,  $^{224}\text{Ra}$ ,  $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ ,  $^{222}\text{Rn}$ ,  $^{87}\text{Sr}/^{86}\text{Sr}$ ) of Radium Mobilization and Retardation In the Mt. Simon Aquifer, Minnesota. *GSA Abstracts with Programs*, GSA, Vol. 40, No. 6, p. 339.

Vengosh, A. (2007) Isotopic Reconnaissance of water quality degradation in the Middle East. Geological Society of America (GSA) Annual Meeting, Denver (28-31 October 2007); *GSA Abstracts with Programs*, GSA Vol. 39, No. 6, p. 342.

Vengosh, A. Kloppmann, W., Guerrot, C., Millot, R., Pankratov, I. (2007). The isotopic composition of man-made fresh water: Seawater and brackish groundwater reverse osmosis desalination. Geological Society of America (GSA) Annual Meeting, Denver (28-31 October 2007); *GSA Abstracts with Programs*, Vol. 39, No. 6, p. 114.

**Vinson, D.H., Hirschfeld, D.**, Dwyer, G. and Vengosh, A. (2007) Radium and radon in fresh groundwater: Insights along solute and redox gradients in the North Carolina Piedmont. Geological Society of America (GSA) Annual Meeting, Denver (28-31 October 2007); *GSA Abstracts with Programs*, Vol. 39, No. 6, p. 178.

**Raanan, H.**, Vengosh, A., Nishri, A., Paytan, A. (2007) radium isotopes as a proxy for groundwater-fresh water lake interaction: A case study from the Sea of Galilee, Israel. Geological Society of America (GSA) Annual Meeting, Denver (28-31 October 2007); *GSA Abstracts with Programs*, Vol. 39, No. 6, p. 479.

Vengosh, A., **Peri, N.**, Haquin, G., Paytan, A., Pankratov, I., Elhanani, S., Karpas, Z. (2007) Mechanisms of Radium Mobilization for Radium-Rich Groundwater from the Nubian Sandstone and Carbonate Aquifers in the Negev, Israel: Implications for Fossil Groundwater Resources in the Middle East. American Geophysical Union, Joint Assembly, Acapulco, Mexico, May 22-35, 2007.

Vengosh, A. Campbell, T., **Vinson, D.**, Klein, E., Dwyer, G., Benneer, L., Weinthal, E., Wiesner, M., Pratson, E. and Miranda, M.L. (2006) Natural contaminants in private wells in North Carolina. USDA-CSREES 2007 National Water Quality Conference. January 28-February 1, 2007 Savannah, Georgia.

**Vinson, D.H.**, Campbell, T.R., Field, R.W., and Vengosh, A. (2006) Transfer of radon from

groundwater into homes and the contribution of showering to indoor radon: Policy implications for unregulated private well owners at the intersection of geology and health in the North Carolina Blue Ridge. Geological Society of America *Abstracts with Programs*, Vol. 38, No. 7, p. 122. 2006 Philadelphia Annual Meeting (22–25 October 2006).

Vengosh, A., **Pery, N.**, Paytan, A. Haquin, G., Elhanany, S. and Pankratov I. (2005). Sources, mechanisms, and implications for natural radionuclide contamination in groundwater basins in the Middle East. Geological Society of America, Salt lake City, Utah, October 2005.

Vengosh, A., **Pery, N.**, Paytan, A. Haquin, G., Elhanany, S. and Pankratov I. (2004). Tracing the Origin of Radioactivity in Groundwater from the Negev, Israel. American Geophysical Union, San Francisco, December 2004.

Vengosh, A., **Hening, S.**, Ganor, J., Bullen, T.D., Weyhenmeyer, C.E., Sturchio, N.C., and Paytan, A. (2004). The origin and age of groundwater in the Nubian Sandstone aquifer in the Negev, Israel, *in* Wanty, R.B., and Seal, R.R., II, eds., *Water Rock Interaction*, v. 1, Proceedings of the Eleventh International Symposium on Water-Rock Interaction, Saratoga Springs, New York, July 2004: New York, A.A. Balkema, p. 509-512.

Vengosh, A. Weinthal, E., Marei, A., Gutierrez, A., Kloppmann, W. (2003). Addressing the Water Crisis in the Gaza Strip: Integration of Geochemistry, Numerical modeling, and Policy. American Geological Society, Seattle, Washington, USA. November 2-5, 2003.

Vengosh, A., Marei, A., Guerrot, C., Pankratov, I. (2002). An enigmatic salinity source in the Mediterranean coastal aquifer and Gaza Strip: Utilization of isotopic (B, Sr, O) constraints for searching the sources of groundwater contamination. Goldschmidt Conference, Davos, Switzerland, August 18-23, 2002. *Geochim. Cosmochim. Acta*, **66**, A804.

**Farber, E.**, Vengosh, A., Shavit, U., **Holtzman, R.**, **Segal, M.**, Gavrieli, I., and Bullen, T. (2002). Exploring the Sources of the salinity in the Lower Jordan River. International symposium on the Geochemistry of the Earth's Surface (GES-6). Honolulu, Hawaii, May 2002, Abstracts Volume Sixth, 135-155 pp.

Vengosh, A., **Farber, E.**, Shavit, U., Holtzman, R., Segal, M., Gavrieli, I., Bullen, T.M., and Mayer, B. (2001). What Science can contribute for future cooperation in the Middle East: The Jordan River. American Water Resources Association, International Specialty Conference on Globalization and Water management: the Changing Value of Water. August 6-8 2001, Dandee, Scotland, UK.

Vengosh, A., **Farber, E.**, Shavit, U., **Holtzman, R.**, **Segal, M.**, Gavrieli, I., Bullen, T.M., (2001). *Exploring the sources of salinity in the Middle East: A hydrologic, geochemical and isotopic study of the Jordan River*. In: Cidu, R., Proceeding of the Tenth International Symposium on Water-Rock Interaction, WRI-10, Villasimuis, Sardinia, Italy, June 2001, (keynote lecture), Vol. 1, 71-79, A.A. Balkema Publishers.

Vengosh, A., **Farber, E.**, Shavit, U., Holtzman, R., Segal, M., Gavrieli, I., Bullen, T.M., and Mayer, B. (2001). *Tracing the origin of salinity of the Jordan River*. 4<sup>th</sup> International Symposium on Applied Isotope Geochemistry, June 25-29, 2001, Pacific Grove, California, USA, pp. 162-164.

Vengosh, A., Kolodny Y. and A.J. Spivack (1998) *Ground-water pollution determined by boron isotope systematics*. In: *'Application of isotopic techniques to investigate groundwater pollution'*, Cooperation Research Program, The International Atomic Energy Agency (IAEA), IAEA-TECDOC-1046, pp. 17-37, October 1998, Vienna.

Vengosh A. (1992). *Boron isotope variations during brine evolution and water-rock interaction*. Kharaka Y.K. and Maest A.S. (eds.), *Proceedings of the 7th International Symposium on Water-Rock Interaction*, Park City, Utah, 1992. A.A. Balkema, Rotterdam, p. 693-696.

## TEACHING

**Courses at Duke University:** Introduction to Hydrogeology (EOS123), International Water Resources (EOS227), Stable and Radioactive Isotopes in Environmental Sciences (EOS271), Water Seminar (EOS226).

### Graduate students:

#### Duke University:

- Hadas Raanan (PhD, 2005-). Research topic: *Radium isotope geochemistry as a tracer for groundwater-surface water interaction*.
- David Vinson (PhD, 2005-). Research topic: *The impact of salinity and water chemistry on radium mobilization in groundwater systems*.
- Nathanel Warner: (PhD, 2008-). Research topic: *Tracing the origin of salinization and radium contamination in water resources of Morocco*.
- Laura Ruhl (PgD, 2008-). Research topic: *The geochemistry and isotopic characterization of coal ash and its impact on the environment*.
- Brittany R. Merola (PhD-2010 -). Research topic: *Biomarkers of arsenic and fluoride from contaminated water resources*.
- Daniella Hirschfeld (Master of Environmental management, 2006-2008). Research topic: *Radium isotopes in groundwater in Jordan*.
- Kristen Tull (Master of Environmental management, 2006-2008). Research topic: *Mini-Superfund" Site in Kawerau, New Zealand: A Closer Look at Water Quality*.
- Britany R. Merola (Master of Environmental management, 2007-2009). Research topic: *Arsenic Exposure from Groundwater in Union County, North Carolina*.
- Heidi Hausman (Master of Environmental management, 2007-2009). Research topic: *Responsible Development in Tulum, Mexico: Considering Water Quality and Subaqueous Cave Locations*.

#### Ben Gurion University:

- Efrat Farber (PhD, 2000-2005). Research topic: *The lower Jordan River: river salinization, relationship with adjacent groundwater and future management*.
- Yohanan Artzi (M.Sc., 1999-2003) Research topic: *The origin of salinity in the coastal aquifer of Israel*.
- Osnat Velder (M.Sc., 2000-2003) Research topic: *Mapping of oxygen isotopes and salinity in groundwater from the coastal aquifer of Israel*.

- Sharona Henig (M.Sc., 2002-2004) Research topic: *Geochemical and isotopic (oxygen, hydrogen, boron, and strontium) characterization of groundwater from the Kurnub Group aquifer in the Negev and the Arava Valley, Israel.*
- Dana Roded (M.Sc., 2003-2005) Research topic: *Identification of the origin of nitrate pollution in the coastal aquifer by isotopic traces.*
- Nitzan Pery (M.Sc., 2003-2005) Research topic: *Radioactivity in groundwater from the Negev, Israel.*

## AWARDS AND GRANTS

### Duke University

- 2010-2013 Oak Ridge Associated Universities. Vengosh, A. (PI), Hsu-Kim, H., Hower, J., Johnson, T. *Geochemical and isotope characterization of TVA coal combustion products: Identification of contaminants and modeling their fate in the environment.* (\$357,115).
- 2010-2011 Duke Global Health Institute. McCornick, P. and Vengosh, A. Processes controlling groundwater quality and impacts on human health in the Main Ethiopian Rift. (\$50,000).
- 2010-2013 DOE. Rob Jackson (PI), Avner Vengosh, Mark Little. *The Potential Risks of Freshwater Aquifer Contamination with Geosequestration Simulation and Risk Assessment of Carbon Capture and Storage (CCS).* (\$298,304).
- 2009-2010 NSF (RAPID track). Vengosh, A. (PI), Backer, P., Dywer, G.S. and Hsu-Kim, H. Title: *Environmental effects of the coal ash spill and remediation at Kingston, Tennessee* (\$105,000).
- 2009 Fred and Alice Stanback gift to the Nicholas School of Environment. Vengosh, A. (PI). Seed funding *The Environmental and Health Effects of the coal ash spill at Kingston, Tennessee* (\$50,000).
- 2008-2011 NATO Science for Peace and Security Program. Vengosh A. and Bouchaou, L. (PI). *Investigating salinity and radioactivity in water resources in Morocco.* (EUR 234,000).
- 2008-2009 Center of Global Change, Duke University. Vengosh, A. (PI) Jackson, R. Hsu-Kim, H. Emily S. Bernhardt, E.S. *The drought effect on water availability and quality of North Carolina water resources: Groundwater-surface water interaction and contributions of recycled wastewater* (\$50,000)
- 2007-2009 Kuwait Institute for Scientific Research (KISR). Vengosh, A. (PI). *Radium isotopes in the Persian Gulf and associated groundwater.* (\$30,000).

- 2007-2008 Health Research Council of New Zealand, Hikuroa, D. and Vengosh, A. (PI's); *"Preliminary investigation of the link between naturally occurring contaminants and health in Tarawera Valley, New Zealand"*; (\$5,000).
- 2006-2009 United States Department of Agriculture (USDA). Vengosh, A. (PI), Klein, E. Benneer, L., Weinthal, E. Wiesner, M., Mirenda M. *An integrative investigation of the sources and effects of groundwater contamination for local communities and homeowners in North Carolina* (\$570,000).
- 2006-2009 United States Agency for International Development (US-AID), Middle East Research Program (MERC). Ganor, J. (PI), Vengosh, A. , Marie, A. Rimawi, O. (PIs). *The salinity curse of the Middle East fossil groundwater: The Radioactivity factor* (\$500,000).
- 2005-2006 Cancer and the Environment: Seed Funding Award of Duke Comprehensive Cancer Center and Nicholas School of the Environment, Duke University. Avner Vengosh (PI), James J. Vredenburg, Jennifer Garst, Richard Di Giulio, Lincoln Pratson, and Emily M. Klein. *"The Link Between Environmental Radon and Cancer: A Pilot Study For a New Biogeochemical Tracer and Geographical Relationships"* (\$25,000).

#### **Ben Gurion University, Beer Sheva, Israel**

- 2003-2004 Blaustein Visiting Scholar award, School of Earth Sciences, Stanford University, California, USA.
- 2002-2005 United States States Agency for International Development (US-AID), Middle East Research Program (MERC). Vengosh, A. (PI), U. Shavit, I. Gavrieli, E. Salameh, R. Daud, A. Marie. *"Water Quality along the Jordan River and evaluation of the sources of salts: Phase Two"* (\$499,000)
- 2001-2004 Water Commission, Israel. Vengosh, A. *"Using isotopic tracers for elucidating the sources and mechanism of nitrate pollution of groundwater from the coastal aquifer of Israel"* (300,000 NIS).
- 2001-2004 European Community: FP5 program" Energy, Environment and Sustainable Development", "Sustainable Management and Quality of Water". Kloppmann, W., Vengosh, A. et al., *"Boron contamination of Water resources in the Mediterranean region: Distribution, Sources, Social impact and Remediation"* (Euro 1,200,000 for the total project, Euro 120,000 for BGU).
- 2000-2003 International Atomic Energy Agency, Research Co-operation Projects, Y. Ganor and A. Vengosh, *"Boron and strontium isotopic compositions of ground water from the Lower Cretaceous Kurnob sandstone: Geochemical characterization of inland saline ground water"* (\$15,000)

- 1999-2003 United States Agency for International Development (US-AID), Middle East Research Program (MERC). Vengosh, A. (PI), U. Shavit, I. Gavrieli, E. Salameh, R. Daud, A. Marie. "*Water Quality along the Jordan River and evaluation of the sources of salts: A geochemical prospective*" (\$499,000)
- 1999-2002 International Atomic Energy Agency, Research Co-operation Projects, Vengosh, A. "*Environmental Isotopes, Boron, and Bromide Variations in the Coastal Aquifer of Israel: The Impact of Long-term Exploitation*" (\$18,000).
- 1999-2000 Department of Energy, Lawrence Livermore National Laboratory. Vengosh, A., Marie, A., "*The Mediterranean Coastal aquifer and the Shallow Aquifer System in Jericho area*" (\$12,000).
- 1998-2001 Ministry of Science, Israel. I. Gavrieli (PI), Y. Yechieli, A. Vengosh, A. Starinsky, "*Dating and geochemical characterization of shallow ground water from the coastal aquifer of Israel*". (\$190,000)

#### **Hydrological Service, Jerusalem, Israel**

- 1997-1998 University of California Water Resources. J. Gill and A. Vengosh. "*Multi-isotope investigation of ground water contamination in Salinas Valley, California*". (\$25,000).
- 1995 –1998 Israel Academy of Science. I. Gavrieli (PI), A. Starinsky (PI), A. Vengosh, A. Ayalon. "*Boron, sulfur, strontium, oxygen, and hydrogen isotopes in freshwater of a carbonate aquifer: Judea Mountain, Israel*". (\$140,000).
- 1996 - 1998 Water Commission Research grants. A. Starinsky and A. Vengosh. "*Relationships between contaminates and salinity in the coastal aquifer of Israel*" (210,000 NIS)
- 1995 -1997 International Atomic Energy Agency (IAEA). Y. Kolodny and A. Vengosh. "*Boron isotope investigations of polluted groundwater and contamination sources: Establishing the rules of the game*" (\$12,000).
- 1992 - 1995 The German-Israeli Cooperative Grant (BMFT and MOST). A. Vengosh, R. Keren, K.G. Heumann (PI's). "*The influence of the coastal aquifer rocks on groundwater composition and contamination*". (148,000 DM).
- 1993 - 1995 The Ashdod-Yavneh Regional Association for Environmental Protection. A. Vengosh. "*Sources of Salinization of Groundwater from Gan Yavne-Gedera-Ashdod Area, the Coastal Plain Aquifer, Israel*" (100,000 NIS).
- 1993 - 1996 Water Commission Research grants. Y. Yechieli, (PI), D. Ronen, and A. Vengosh. "*Isotopic measurements and dating of intrusion of saline groundwater at the interface zone, the Coastal Plain Aquifer of Israel*". (160,000 NIS).



- 1993 - 1996 Water Commission Research grants. A. Starinsky and A. Vengosh. "*A survey of natural isotopic and chemical tracers in groundwater from Yarqon-Taninim aquifer as indicators for salinization*" (210,000 NIS).
- 1991 - 1994 Water Commission Research grants. E. Mazor and A. Vengosh. "*A conceptual model for aquifer systems in the coastal plain of Israel: A pilot study along Tel Aviv-Judea Mountain*" (240,000 NIS).
- 1986 – 1990 Research School of earth Sciences, The Australian National University, Canberra, Australia. Ph.D. Scholarship for Avner Vengosh.

## Media:

### Research on water resources in the Gaza Strip

- November 3, 2003 - Geological Society of America: *Water On The Gaza Strip: Time Bomb Or Ray Of Hope* (<http://www.geosociety.org/news/pr/03-34.htm>)
- November 13, 2003 - Nature 426, 110 (13 November 2003) | doi:10.1038/426110b  
*Geologists call for desalination of Gaza Strip's water*  
(<http://www.nature.com/nature/journal/v426/n6963/full/426110b.html>)
- March 4, 2003 - Environmental Change and Security Program: *The State of the Water Crisis in Israel and The Palestinian Authority: Integrating Science and Policy*  
([http://www.wilsoncenter.org/index.cfm?topic\\_id=1413&categoryid=A82CCAEE-65BF-E7DC-46B3B37D0A3A575F&fuseaction=topics.events\\_item\\_topics&event\\_id=23109](http://www.wilsoncenter.org/index.cfm?topic_id=1413&categoryid=A82CCAEE-65BF-E7DC-46B3B37D0A3A575F&fuseaction=topics.events_item_topics&event_id=23109))

### Research on Radioactivity and fossil groundwater in the Middle East

- May 6, 2010, National Geographic News: "*Underground "Fossil Water" Running Out*" (<http://news.nationalgeographic.com/news/2010/05/100505-fossil-water-radioactive-science-environment/>)
- February 25, 2009 - Reuters, London: Ancient Jordanian wells radioactive, study finds (<http://www.reuters.com/article/latestCrisis/idUSLN96135>)
- February 26, 2009 - The Jerusalem Post: Radioactive materials found in Jordanian wells ([www.jpost.com/servlet/Satellite?cid=1235410729639&pagename=JPost%2FJPostArticle%2FPrinter](http://www.jpost.com/servlet/Satellite?cid=1235410729639&pagename=JPost%2FJPostArticle%2FPrinter))
- February 27, 2009 - The Jordan Times : Government: water is safe (<http://www.jordantimes.com/?news=14653>)
- March 9, 2009 - The Jordan Times: Clear waters (<http://www.jordantimes.com/?news=14872>)
- March 4, 2009 - Green Prophet: Study on Jordanian Groundwater Sparks Controversy (<http://greenprophet.com/2009/03/04/7321/jordan-groundwater-controversy/>)
- March 3, 2009 - KISR will check; Aquifer 'radiation' in Kuwait unlikely (<http://www.arabtimesonline.com/kuwaitnews/pagesdetails.asp?nid=29378&ccid=9>)
- February 23, 2009 - The New Security Beat: Hot Water: High levels of radioactivity found in Jordan's groundwater (<http://newsecuritybeat.blogspot.com/2009/02/hot-water-high-levels-of-radioactivity.html>).

- March 6, 2009 - The Grist: Tall Glass of denial - Fallout from Jordan's radioactive water (<http://www.grist.org/article/Tall-glass-of-denial>)
- March 6, 2009 - Science Daily: Jordan's Fossil Water Source Has High Radiation Levels (<http://www.sciencedaily.com/releases/2009/02/090224163647.htm>).
- February 25, 2009 - Haaretz: Report: Mideast in danger of exposure to high levels of radioactive water (<http://www.haaretz.com/hasen/spages/1066925.html>).
- March 1, 2009 - Jordan Science and Environment Monitor: The Curious case of radioactivity in Disi aquifer (<http://www.arabenvironment.net/archive/2009/3/816500.html>).
- February 24, 2009 - Bio-Medice: Jordan fossil water source has high radiation levels (<http://www.bio-medicine.org/medicine-news-1/Jordans-fossil-water-source-has-high-radiation-levels-37588-2/>).
- March 17, 2009 - International Water and Sanitation Centre: Jordan: ancient wells radioactive, US study finds (<http://www.irc.nl/page/47171>).
- March 9, 2009 - Middle East Business Information (ZAWYA): Clean waters (<https://www.zawya.com/Story.cfm/sidZAWYA20090309034554/Clear%20waters/>).
- February 25, 2009 - World Bulletin: Ancient Jordan water high level radioactive, study says ([http://www.worldbulletin.net/news\\_detail.php?id=37261](http://www.worldbulletin.net/news_detail.php?id=37261)).
- February 26, 2009 - Boston Globe: Excess radiation found in ancient Jordan wells ([http://www.boston.com/news/world/europe/articles/2009/02/26/excess\\_radiation\\_found\\_in\\_ancient\\_jordan\\_wells/](http://www.boston.com/news/world/europe/articles/2009/02/26/excess_radiation_found_in_ancient_jordan_wells/)).
- April 1, 2009 - JO: Poisoning The Well ([http://www.jo.jo/index.php?option=com\\_content&view=article&id=306:poisoning-the-well&catid=81:politics&Itemid=197](http://www.jo.jo/index.php?option=com_content&view=article&id=306:poisoning-the-well&catid=81:politics&Itemid=197)).
- March 2, 2009 - Jordan Times: No hidden agenda behind water study – researcher (<http://www.jordantimes.com/?news=14692>).
- August 2009, Jordan's Radioactive Water Problem. IEEE Spectrum (<http://www.spectrum.ieee.org/energy/environment/jordans-radioactive-water-problem>)

### Research on the TVA coal ash spill, Kingston, Tennessee

- November 29, 2010, Science Daily News: *Scientists Look Deeper for Coal Ash Hazards* (<http://www.sciencedaily.com/releases/2010/11/101129203342.htm>)
- November, 29, 2010, Duke press release: *New Monitoring Methods More Accurately Measure Coal Ash Impacts* (<http://www.nicholas.duke.edu/news/new-monitoring-methods-more-accurately-measure-coal-ash-impacts>)
- December 6, 2010, Chemical and Engineering News, American Chemical Society: *Coal Ash Spill In Tennessee Still A Problem* (<http://pubs.acs.org/cen/news/88/i49/8849news1.html>)
- December 1, 2010, Technology Magazine Daily: *Scientists Look Deeper for Coal Ash Hazards* (<http://www.techmagdaily.com/scientists-look-deeper-for-coal-ash-hazards.html>)

- December 8, 2010, Facing South: *Scientists call for a deeper look at coal ash contamination* (<http://www.southernstudies.org/2010/12/scientists-call-for-a-deeper-look-at-coal-ash-contamination.html>)
- Sep 15, 2010, Scientific American: *On eve of EPA hearings, scientists sample lake for coal-ash toxins* (<http://www.scientificamerican.com/blog/post.cfm?id=on-eve-of-epa-hearings-scientists-s-2010-09-15>)
- Sep 13, 2010. Duke Press release: *Duke Expert to Testify on Coal Ash's Effects on Hyco Lake, TVA Pond* ([http://www.dukenews.duke.edu/2010/09/tip\\_vengosh.html](http://www.dukenews.duke.edu/2010/09/tip_vengosh.html))
- August 17, 2009, Toxics in coal ash from TVA Ash Spill May Pose Risks to the Environment. Duke Press release (<http://www.nicholas.duke.edu/news/ns-tva.08.17.09.html>)
- May 13, 2009 – WBIR: Warmer weather raises risks associated with TVA ash spill (<http://www.wbir.com/news/local/story.aspx?storyid=87506&provider=rss>)
- March 30, 2009 - Testimony to the Subcommittee on Water Resources & Environment, U.S. House of Representatives -Tennessee Valley Authority's Kingston Ash Slide: Potential Water Quality Impacts of Coal Combustion Water Storage (<http://transportation.house.gov/hearings/hearingDetail.aspx?NewsID=834>)
- January 28, 2009 – Duke Today: Analysis Shows Exposure to Ash from TVA Spill Could Have "Severe Health Implications" (<http://www.nicholas.duke.edu/news/ns-vengosh.01.28.09.html>; <http://www.dukenews.duke.edu/2009/01/tva.html>)
- January 30, 2009 – The Huffington Post: Exposure To TVA Coal Spill Could Have 'Severe Health Implications' ([http://www.huffingtonpost.com/2009/01/30/exposure-to-tva-coal-spill\\_n\\_162471.html](http://www.huffingtonpost.com/2009/01/30/exposure-to-tva-coal-spill_n_162471.html)).
- April 1, 2009 - Chattanooga Time: 100 Days Later, Ash Spill Questions Linger for Tennessee Valley Authority (<http://www.istockanalyst.com/article/viewiStockNews/articleid/3166217>)
- February 2, 2009 – Facing South: Fallout fallacies: How TVA misled on coal ash radiation threat (<http://www.southernstudies.org/2009/02/fallout-fallacies-how-tva-misled-on-coal-ash-radiation-threat.html>).
- January 29, 2009 – Knoxville News Sentinel: Coal ash health risk, Duke finds (<http://www.knoxnews.com/news/2009/jan/29/coal-ash-health-risk-duke-finds/?printer=1/>)
- January 29, 2009 – The Huffington Post: Tennessee Coal Ash Contaminated With Radioactivity and Arsenic ([http://www.huffingtonpost.com/bill-chameides/tennessee-coal-ash-contam\\_b\\_162336.html](http://www.huffingtonpost.com/bill-chameides/tennessee-coal-ash-contam_b_162336.html)).
- May 2009 – Dukeenvironment Magazine: Raising the Question of Safety (<http://www.nicholas.duke.edu/dukenvironment/sp09/raising-the-question-of-safety>).

- January 29, 2009 – Associated Press: Arsenic, radium levels high at ash spill site (<http://www.msnbc.msn.com/id/28917966/>)
- February 4, 2009 – The Nation: Toxic Coal in Tennessee (<http://www.thenation.com/doc/20090223/hearn>)

#### **News Releases - Duke:**

- June 09, 2008 - "Man-made" Water has Different Chemistry - -- Duke University (<http://news.duke.edu/2008/06/tracewater.html>)
- September 15, 2006 - Health Risks of Radon in North Carolina Groundwaters to be Examined at Nicholas School Workshop on Oct. 4 (<http://www.nicholas.duke.edu/news/ns-radon.html>)

#### **Others**

- October 4, 2006; The News and Observer: Experts address N.C. radon hazard (<http://www.newsobserver.com/102/story/494204.html>)
- April 1, 2006; Washington Post: April 01, 2006 - EPA May Weaken Rule on Water Quality.
- July 14, 2004; BBS news: South Israeli water 'radioactive' ([http://news.bbc.co.uk/2/hi/middle\\_east/3894263.stm](http://news.bbc.co.uk/2/hi/middle_east/3894263.stm))