

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE SECRETARY

In the Matter of)	
)	
Tennessee Valley Authority)	Docket No. 52-047-ESP
)	
(Clinch River Nuclear Site))	
)	

**DECLARATION OF DR. EDWIN S. LYMAN IN SUPPORT OF
PETITIONERS' CONTENTION 1 (EMERGENCY PLANNING)**

Under penalty of perjury, Edwin S. Lyman declares as follows:

1. My name is Edwin S. Lyman. I am a Senior Scientist at the Union of Concerned Scientists.
2. I am a qualified expert on matters relating to nuclear power plant safety and security. I earned a doctorate in physics from Cornell University in 1992. From 1992 to 1995, I was a postdoctoral research associate at Princeton University's Center for Energy and Environmental Studies (now the Science and Global Security Program), where my research focused on the prevention of nuclear proliferation, nuclear and radiological terrorism, and nuclear accidents. I have published articles and letters regarding those issues in journals and magazines including *Science*, *Nature*, *The Bulletin of the Atomic Scientists*, *Science and Global Security*, *Arms Control Today*, *Nuclear Engineering International*, *New Scientist* and *Energy and Environmental Science*. I am a co-author (with David Lochbaum and Susan Q. Stranahan) of the book *Fukushima: The Story of a Nuclear Disaster* (The New Press, 2014).
3. I have considerable experience and expertise with respect to the issue of spent fuel pool fire risks, and have briefed both the NRC and the National Academy of Sciences on issues related to pool fire risks. In addition, I am a co-author of the article "Nuclear Safety Regulation in the Post-Fukushima Era," which was published in *Science* magazine on May 26th, 2017 and focuses on spent fuel pool fire risks. A copy of my curriculum vitae is attached.
4. I am familiar with the licensing-related filings and correspondence that have been submitted by Tennessee Valley Authority ("TVA") in support of its application for an Early Site Permit for a Small Modular Reactor ("SMR") on the Clinch River Nuclear Site. I am also familiar with applicable regulations, policies, and guidance documents of the U.S. Nuclear Regulatory Commission ("NRC").
5. I assisted Petitioners with the preparation of their Contention 1, which challenges

TVA's request for an exemption from NRC's emergency planning requirements. The factual assertions in the contention are true and correct to the best of my knowledge, and the opinions expressed therein are based on my best professional judgment.

A handwritten signature in black ink, appearing to read "Edwin S. Lyman". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Edwin S. Lyman, Ph.D.

June 9, 2017

Edwin Stuart Lyman
Curriculum Vitæ

Education

Ph.D, Cornell University, Theoretical Physics, August 1992.

M.S., Cornell University, Physics, January 1990.

A.B., *summa cum laude*, New York University, Physics, June 1986; Phi Beta Kappa.

Professional Experience

May 1, 2003 – Present: Senior Scientist, Union of Concerned Scientists.

Spring 2015: Adjunct Professor, Elliott School of International Affairs, The George Washington University, Washington, DC. Taught Master's level course on nuclear energy.

June 2002 – April 2003: President, Nuclear Control Institute, Washington, D.C.

July 1995 – May 2002: Scientific Director, Nuclear Control Institute, Washington, D.C.

August 1992 – June 1995: Postdoctoral research associate, Center for Energy and Environmental Studies, Princeton University, Princeton, NJ.

Spring 1995: Preceptor for Environmental Studies 302, "Perspectives on Environmental Issues: Values and Policies."

Spring 1994: Lecturer, Woodrow Wilson School. Preceptor for WWS 304, "Science, Technology and Public Policy."

July 1988 – June 1992: Graduate research assistant, Newman Laboratory of Nuclear Studies, Cornell University, Ithaca, NY. Conducted thesis research on high-energy physics under the supervision of Prof. S.H.-H. Tye.

August 1986–June 1988: Andrew D. White Graduate Fellow, Physics, Cornell University.

Other

Active Nuclear Regulatory Commission "L" clearance

Books and Book Chapters

D. Lochbaum, E. Lyman and S.Q. Stranahan, *Fukushima: The Story of a Nuclear Disaster*. The New Press, New York, 2014.

E. Lyman, "Nuclear Energy and Human Health," *Encyclopedia of Environmental Health*, Elsevier Science, 2011.

E. Lyman, "Can Nuclear Fuel Production in Iran and Elsewhere be Safeguarded Against Diversion?" in *Falling Behind: International Scrutiny of the Peaceful Atom* (H.D. Sokolski, ed.), Strategic Studies Institute, U.S. Army War College, 2008, 101-120.

E. Lyman and D. Lochbaum, "Protecting Vital Targets: Nuclear Power Plants," in *Homeland Security: Protecting America's Targets, Vol. III* (J. Forest, ed.), Praeger, Westport, CT, 2006, 157-173.

E. Lyman, "The Limits of Technical Fixes," in *Nuclear Power and The Spread of Nuclear Weapons: Can We Have One Without the Other?* (P. Leventhal, S. Tanzer and S. Dolley, eds.), Brassey's, Washington, DC, 2002, 167-182.

Journal Articles and Letters

E. Lyman, M. Schoeppner and F. von Hippel, "Nuclear Safety Regulation in the Post-Fukushima Era," *Science* **356** (2017), 808-809.

E. Lyman and F. von Hippel, "Nuclear Waste: Weapons Plutonium Riskier Above Ground" (letter), *Nature* **530** (2016), 281.

T. Clements, E. Lyman and F. von Hippel, "The Future of Plutonium Disposition," *Arms Control Today*, June/July 2013.

J. Beyea, E. Lyman and F. von Hippel, "Accounting for Long-Term Doses in 'Worldwide Health Effects of the Fukushima Daiichi Nuclear Accident'," *Energy and Environmental Science* **6** (2013), 1042-1045.

E. Lyman, "Rotblat's Pursuit of Nuclear Peace," *New Scientist*, January 25, 2012.

E. Lyman, Surviving the One-Two Nuclear Punch. *Bulletin of the Atomic Scientists online*, September 2011.

E. Lyman, "Security Since September 11th," *Nuclear Engineering International*, May 20, 2010.

E. Lyman, "Thirty Years after TMI: Five Continuing Vulnerabilities," *Bulletin of the Atomic Scientists*, March 23, 2009.

E. Lyman, "Making Domestically Produced Medical Isotopes a National Priority," *Bulletin of the Atomic Scientists*, December 18, 2008.

E. Lyman, "Can Nuclear Plants be Safer?" *Bulletin of the Atomic Scientists*, September/October 2008, 34-37.

E. Lyman and F. von Hippel, "Reprocessing Revisited: The International Dimensions of the Global Nuclear Energy Partnership," *Arms Control Today*, April 2008, 6-14.

J. Beyea, E. Lyman and F. von Hippel, "Damages from a Major Release of ^{137}Cs Into the Atmosphere of the United States," *Science and Global Security* **12** (2004) 125-136.

G. Bunn, C. Braun, A. Glaser, E. Lyman and F. Steinhausler, "Research Reactor Vulnerability to Sabotage by Terrorists," *Science and Global Security* **11** (2003) 85-107.

D. Hirsch, D. Lochbaum and E. Lyman, "The NRC's Dirty Little Secret," *Bulletin of the Atomic Scientists* (May/June 2003).

R. Alvarez, J. Beyea, K. Janberg, J. Kang, E. Lyman, A. Macfarlane, G. Thompson and F. von Hippel, "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States," *Science and Global Security* **11** (2003) 1-51.

E. Lyman, "Revisiting Nuclear Power Plant Safety" (letter), *Science* 299 (2003), 202.

E. Lyman, "The Pebble-Bed Modular Reactor: Safety Issues," *Physics and Society*, American Physical Society, October 2001.

E. Lyman, "Public Health Risks of Substituting Mixed-Oxide for Uranium Fuel in Pressurized Water Reactors," *Science and Global Security* **9** (2001), 1.

E. Lyman and S. Dolley, "Accident Prone," *Bulletin of the Atomic Scientists*, March/April 2000, 42.

E. Lyman and H. Feiveson, "The Proliferation Risks of Plutonium Mines," *Science and Global Security* **7** (1998), 119.

E. Lyman and P. Leventhal, "Bury the Stuff [Weapons Plutonium]," *Bulletin of the Atomic Scientists*, March/April 1997, 45.

E. Lyman, "Weapons Plutonium: Just Can It," *Bulletin of the Atomic Scientists*, November/December 1996, 48.

F. von Hippel and E. Lyman, "Appendix: Probabilities of Different Yields," addendum to J. Mark, "Explosive Properties of Reactor-Grade Plutonium," *Science and Global Security* **4** (1993), 125.

F. Berkhout, A. Diakov, H. Feiveson, H. Hunt, E. Lyman, M. Miller, and F. von Hippel, "Disposition of Separated Plutonium," *Science and Global Security* **3** (1993), 161

E. Lyman, F. Berkhout and H. Feiveson, "Disposing of Weapons-Grade Plutonium," *Science* **261** (1993) 813.

P. Argyres, E. Lyman and S.H.-H. Tye, "Low-Lying States of the Six-Dimensional Fractional Superstring," *Phys. Rev. D* **46** (1992) 4533.

S.-w. Chung, E. Lyman and S.H.-H. Tye, "Fractional Supersymmetry and Minimal Coset Models in Conformal Field Theory," *Int. J. Mod. Phys A* **7** (1992) 3337.

Selected Reports

E. Lyman, "Preventing an American Fukushima," Union of Concerned Scientists, March 2016.

E. Lyman, "Excess Plutonium Disposition: The Failure of MOX and the Promise of Its Alternatives," Union of Concerned Scientists, December 2014.

E. Lyman, "Small Isn't Always Beautiful: Safety, Security and Cost Concerns About Small Modular Reactors," Union of Concerned Scientists, September 2013.

D. Lochbaum and E. Lyman, "U.S. Nuclear Power Safety One Year After Fukushima," Union of Concerned Scientists, March 2012.

L. Gronlund, D. Lochbaum and E. Lyman, "Nuclear Power in a Warming World," Union of Concerned Scientists, December 2007.

E. Lyman (with M. Schneider et al.), "Residual Risk: An Account of Events in Nuclear Power Plants Since the Chernobyl Accident in 2006," commissioned by the Greens of the European Parliament, May 2007.

E. Lyman, "Chernobyl on the Hudson? The Health and Environmental Impacts of a Terrorist Attack at the Indian Point Nuclear Power Plant," commissioned by Riverkeeper, Inc., September 2004.

E. Lyman, "Safety Issues in the Sea Shipment of Vitrified High-Level Radioactive Wastes to Japan," report sponsored by the Nuclear Control Institute, Greenpeace International and Citizens' Nuclear Information Center Tokyo, December 1994.

E. Lyman, "Interim Storage Matrices for Excess Plutonium: Approaching the 'Spent Fuel Standard' Without the Use of Reactors," PU/CEES Report No. 286, Center for Energy and Environmental Studies, Princeton University, August 1994.

E. Lyman, "The Solubility of Plutonium in Glass," PU/CEES Report No. 275, Center for Energy and Environmental Studies, Princeton University, April 1993.

Selected Invited Talks and Testimony

"Perspectives on Security Issues," presentation at NRC Commission closed briefing, June 23, 2016.

Testimony on advanced nuclear reactors before the Senate Committee on Environment and Public Works, Subcommittee on Clean Air and Nuclear Safety, April 21, 2016.

"Alternatives to MOX," presentation to the Savannah River Site Citizens' Advisory Board, Augusta, GA, March 29, 2016 (with Frank von Hippel)

"NRC's Fukushima Response: Lessons Learned and Lessons Unheeded," presentation at the NRC Regulatory Information Conference, March 10, 2016.

"Fixing the NRC's Broken Framework for Reducing Severe Accident Risk," presentation to the NRC Advisory Committee on Reactor Safeguards, December 1, 2015.

"UCS Perspectives on NRC and Industry Actions in Response to Fukushima," presentation at NRC Commission briefing, April 30, 2015.

"Perception versus Reality: UCS Views on Nuclear and Radiological Terrorism Risks," presentation at the Institute of Nuclear Materials Management "Reducing the Risk" Workshop, Washington, DC, March 17, 2015.

"Fukushima and its Lessons for Nuclear Safety," seminar at The Library of Congress, February 19, 2015.

"Production of Mo-99 Without the Use of Highly Enriched Uranium: Perspectives of the Union of Concerned Scientists," presentation to the National Academy of Sciences Committee on Status of Mo-99 Production, February 12, 2015.

"Safety and Security of Spent Fuel Storage in the United States," presentation to the National Academy of Sciences Fukushima Lessons Learned Panel, January 29, 2015.

"UCS Views on the NRC's Human Reliability Program Activities and Analyses," presentation at NRC Commission briefing, May 29, 2014.

"Public Confidence and Force-on-Force Inspections," presentation at the NRC Regulatory Information Conference, March 13, 2014.

"Fukushima: The Story of a Nuclear Disaster," lecture at the Carter Presidential Library, Atlanta,

GA, February 10, 2014.

“UCS Views on NTF Recommendation 1 and the NRC Staff Proposal,” presentation at NRC Commission briefing, January 10, 2014.

“UCS Perspective on Expedited Transfer of Spent Fuel to Dry Casks,” presentation at NRC Commission briefing, January 6, 2014.

“Security Impacts of Emerging Nuclear Technologies,” MITRE STEP Technical Exchange, McLean, VA, December 3, 2013.

“UCS Perspective on Considering Economic Consequences in the NRC’s Regulatory Framework,” presentation at NRC Commission briefing, September 11, 2012.

“Lessons from Fukushima for Improving Nuclear Safety,” American Physical Society March Meeting, Boston, MA, March 1, 2012.

“Lessons from Fukushima for Improving Nuclear Safety,” Physics Department Colloquium, University of Central Florida, February 24, 2012.

Testimony on the Blue Ribbon Commission Report before the House Committee on Energy and Commerce, Subcommittee on Environment and the Economy, February 1, 2012.

“UCS Perspective on the Prioritization of NTF Recommendations,” presentation at NRC Commission briefing, October 11, 2011.

“UCS Perspective on the Japan Task Force Report Short-Term Actions,” presentation at NRC Commission briefing, September 14, 2011.

Testimony on small modular reactors before the Senate Committee on Appropriations, Energy and Water Subcommittee, July 14, 2011.

Testimony on nuclear power legislation before the Senate Energy and Natural Resources Committee, June 7, 2011.

Testimony on the U.S. government response to Fukushima before the House Energy and Commerce Committee, Subcommittee on Oversight and Investigations, April 6, 2011.

Testimony on nuclear safety and Fukushima before the Senate Committee on Environment and Public Works, March 16, 2011.

“UCS Perspective on Maintaining Enhanced Safety for New Reactors,” presentation at NRC Commission briefing, October 14, 2010.

“Limiting Future Proliferation and Security Risks,” presentation to the Blue Ribbon Commission on America’s Nuclear Future, Reactor and Fuel Cycle Technology Subcommittee, October 12, 2010.

“Opportunities in Reactor and Fuel Cycle Technologies ,” presentation to the Blue Ribbon Commission on America’s Nuclear Future, Reactor and Fuel Cycle Technology Subcommittee, August 30, 2010.

“Proliferation and Terrorism Risks of the ‘Nuclear Renaissance,’” New York State American Physical Society meeting, April 24, 2010.

“Reprocessing in the U.S.: Just Say No,” presentation at the NRC Fuel Cycle Information Exchange, June 25, 2009.

“Nuclear Concerns: Safety, Security, Waste and Proliferation,” presentation at the Nuclear Nonoperating Owners’ Group Conference, Baltimore, MD, April 23, 2009.

“NRC Regulation of the Nuclear Fuel Cycle: Safety and Security Concerns,” presentation at the NRC Regulatory Information Conference, March 11, 2009.

“UCS Views on Risk-Informed Regulation,” presentation at NRC Commission briefing, February 4, 2009.

“Licensing Challenges for Fuel Cycle Facilities Under the Global Nuclear Energy Partnership,” U.S. Nuclear Regulatory Fuel Cycle Information Exchange, Rockville, MD, June 12, 2007.

“The ‘Nuclear Renaissance’ and the Spread of Nuclear Weapons,” American Physical Society Ohio Chapter Meeting, May 7, 2007.

“Recycling Nuclear Waste,” American Physical Society Annual April Meeting, Jacksonville, FL, April 15, 2007.

“The Security Imperative of Eliminating Commercial Use of HEU,” presentation to the Committee on Medical Isotope Production Without Highly Enriched Uranium, National Academy of Sciences, Washington, DC, February 15, 2007.

“Recycling Nuclear Waste,” Peace Studies Seminar, Cornell University, November 29, 2006.

“Nuclear Power and Nuclear Proliferation,” Citizens for Global Solutions conference, Washington, DC, November 13, 2006.

“Next-Generation Nuclear Plants: Safety and Security,” presented at “Is Nuclear Power a Solution to Global Warming and Rising Energy Prices?,” American Enterprise Institute conference, Washington, DC, October 6, 2006.

“Recycling Nuclear Waste: Technical Difficulties and Proliferation Concerns,” Physics Department Colloquium, Case Western Reserve University, Cleveland, OH, September 14, 2006.

“The Chernobyl Source Term: Implications for Nuclear Safety,” international conference

“Chornobyl +20: Remembrance for the Future,” Kiev, Ukraine, April 23-25, 2006.

“Public Health Consequences of a Severe Accident or Attack at a Nuclear Plant,” Nuclear Policy Research Institute Conference on Nuclear Power and Global Warming, Airlie House, Warrenton, VA, November 7, 2005.

Testimony before the Subcommittee on Clean Air, Climate Change on Nuclear Safety, Committee on Environment and Public Works, United States Senate, May 26, 2005.

“Safeguarding the U.S. Plutonium Disposition Program Against Nuclear Terrorism,” Science and Global Security Program seminar, Woodrow Wilson School of Public and International Affairs, Princeton University, December 9, 2004.

“Status of the Security Regime for the U.S. Mixed-Oxide Fuel Program,” Managing the Atom Project seminar, Belfer Center for Science and International Affairs, Kennedy School of Government, Harvard University, November 2, 2004.

"U.S. Nonproliferation Policy, Plutonium Disposition and the Threat of Nuclear Terrorism," seminar on "Recycling Plutonium: Risks and Alternatives," sponsored by the Green Group, European Parliament, Brussels, Belgium, January 9, 2003.

"Current Status of the U.S. Plutonium Disposition Program," seminar, Princeton University Program on Science and Global Security, Princeton University, Princeton, NJ, June 12, 2002.

"Controlling Fissile and Radioactive Material," Public Health Summit on Weapons of Mass Destruction, sponsored by Physicians for Social Responsibility and the UCLA School of Public Health, UCLA, Los Angeles, June 2, 2002.

"Assessing the U.S. Government Response to the Nuclear Terrorism Threat After 9/11," presentation to the Joint Atomic Energy Intelligence Committee, McLean, VA, May 9, 2002.

"Upgrading Physical Protection at Nuclear Facilities to Address New Threats," MIT Security Studies Seminar, MIT, Boston, MA, April 18, 2002.

"Perspectives on New Plant Licensing," presentation at the U.S. Nuclear Regulatory Commission Briefing on Readiness for New Plant Applications and Construction, Washington, DC, July 19, 2001.

"Regulatory Challenges for Future Nuclear Plant Licensing: A Public Interest Perspective," U.S. NRC Advisory Committee on Reactor Safeguards (ACRS) Workshop on New Nuclear Plant Licensing, Washington, DC, June 5, 2001.

"The Future of Nuclear Power: A Public Interest Perspective," 2001 Symposium of the Northeast Chapter of Public Utility Commissioners, Mystic, CT, May 21, 2001.

Statement at the U.S. Nuclear Regulatory Commission Briefing on Office of Nuclear Regulatory Research Programs and Performance, May 11, 2001.

"Barriers to Deployment of Micro-Nuclear Technology," presentation at the workshop on "New Energy Technologies: A Policy for Micro-Nuclear Technologies," James A. Baker III Institute for Public Policy, Rice University, Houston, TX, March 19-20, 2001.

"Aging Research and Public Confidence," presentation at the U.S. Nuclear Regulatory Commission 2001 Regulatory Information Conference (RIC), Washington, DC, March 14, 2001.

"NRC Reactor Safeguards Activities," presentation at the U.S. Nuclear Regulatory Commission 2001 Regulatory Information Conference (RIC), Washington, DC, March 14, 2001.

"DOE's Nuclear Material Stabilization Approach: The Failure of Transparency," Embedded Topical Meeting on DOE Spent Nuclear Fuel and Fissile Material Management, American Nuclear Society Annual Meeting, San Diego, CA, June 2000.

"The Status of Reactor Safeguards Initiatives," presentation at the U.S. NRC 2000 Regulatory Information Conference, Washington, DC, March 29, 2000.

"Safety Questions Concerning MOX Fuel Use in Proposed U.S. Reactors," Sixth International Policy Forum on the Management and Disposition of Nuclear Weapons Materials, sponsored by Exchange/Monitor Publications, Washington, DC, June 1999.

"Transparency and Plutonium Disposition," ISIS Workshop on Comprehensive Controls on Plutonium and Highly Enriched Uranium: Long-Term Problems and Prospects for Solutions, sponsored by the Institute for Science and International Security, Washington, DC, June 1997.

"Ship Transportation of Radioactive Materials," presentation to the Marine Board of the National Research Council, U.S. National Academy of Sciences, Woods Hole, MA, June 20, 1996.

"The Importation and Storage of High-Level Radioactive Wastes at Rokkasho-Mura: Safety Concerns," presentation at the Public Forum on High-Level Nuclear Waste and Reprocessing," Aomori, Japan, April 16, 1996.

"Perspectives on U.S. Options for Disposition of Excess Plutonium," Third International Policy Forum on the Management and Disposition of Nuclear Weapons Materials, sponsored by Exchange/Monitor Publications, Landsdowne, VA, March 21, 1996.

"Addressing Safety Issues in the Sea Transport of Radioactive Materials," presentation to the Special

Consultative Meeting of Entities Involved in the Marine Transport of Nuclear Materials Covered by the INF Code," International Maritime Organization, London, March 4-6, 1996.

"Prospects and Unsolved Issues for Plutonium Immobilization," INESAP/IANUS/UNIDIR Fissile Cutoff Workshop, Palais des Nations, Geneva, June 1995.

"An Intermediate Solution for Plutonium from Dismantled Nuclear Warheads," Annual Meeting of the German Physical Society, Berlin, Germany, March 1995.

"The Sea Transport of High-Level Radioactive Waste: Environmental and Health Concerns," Channel Islands International Conference on Nuclear Waste, St. Helier, Jersey, United Kingdom, January 1995.

Conference Papers

E. Lyman, "Security and Nonproliferation Assessment of Breed-and-Burn Systems," GLOBAL 2015 Conference, Paris, France, September 2015.

E. Lyman, "Material Accounting Issues at the MOX Fuel Fabrication Facility," 2014 IAEA Safeguards Symposium, International Atomic Energy Agency, Vienna, Austria, October 2014.

E. Lyman, "Spent Nuclear Fuel Sabotage: An Unnecessary Risk?" 55th Annual Meeting of the Institute of Nuclear Materials Management, Atlanta GA, July 2014.

E. Lyman, "WIPP and Plutonium Disposition: End of the Spent Fuel Standard?" 54th Annual Meeting of the Institute of Nuclear Materials Management, Palm Desert, CA, July 2013.

E. Lyman, "MC&A Issues at the MOX Fuel Fabrication Facility," 53th Annual Meeting of the Institute of Nuclear Materials Management, Orlando, FL, July 2012.

E. Lyman, "A Comprehensive Approach to Protecting Nuclear Facilities and Materials from Terrorist Threats," 2012 Seoul Nuclear Security Symposium, Seoul, Republic of Korea, March 2012.

E. Lyman, "Is Dilution the Solution to the Plutonium Threat?" 52th Annual Meeting of the Institute of Nuclear Materials Management, Palm Desert, CA, July 2011.

E. Lyman, "Resolving a Safeguards Paradox," 2010 IAEA Safeguards Symposium, International Atomic Energy Agency, Vienna, Austria, November 2010.

E. Lyman, "NRC: Taking Spent Fuel Security in the Wrong Direction," 51th Annual Meeting of the Institute of Nuclear Materials Management, Baltimore, MD, July 2010.

- E. Lyman, "Severe Accident Consequence Assessment Regulatory Guidance: A Critique," American Nuclear Society Annual Meeting, San Diego, CA, June 2010.
- E. Lyman, "Promoting Mediocrity: NRC's Policy for New Facility Security Design," 50th Annual Meeting of the Institute of Nuclear Materials Management, Tucson, AZ, July 2009.
- E. Lyman, "Excess Plutonium Disposition: Requiem for a Dream," 49th Annual Meeting of the Institute of Nuclear Materials Management, Nashville, TN, July 2008.
- E. Lyman, "Revising the Rules for Material Protection, Control and Accounting," 8th International Conference on Facility Operations – Safeguards Interface, Portland, OR, March 30 – April 4, 2008.
- E. Lyman, "Regulatory Challenges Facing the Global Nuclear Energy Partnership," GLOBAL 2007 Conference, Boise, ID, September 2007.
- E. Lyman, "Envisioning a World Without Uranium Enrichment," 48th Annual Meeting of the Institute of Nuclear Materials Management, Tucson, AZ, July 2007.
- E. Lyman, "The Global Nuclear Energy Partnership: Will it Advance Nonproliferation or Undermine it?" 47th Annual Meeting of the Institute of Nuclear Materials Management, Nashville, TN, July 2006.
- E. Lyman, "Can Nuclear Fuel Production in Iran and Elsewhere Be Protected Against Diversion?" paper presented at the Nonproliferation Policy Education Center/King's College-London Conference "After Iran: Safeguarding Peaceful Nuclear Energy," London, October 2-3, 2005.
- E. Lyman, "The Erosion of Physical Protection Standards Under the MOX Fuel Program," 46th Annual Meeting of the Institute of Nuclear Materials Management, Phoenix, AZ, July 2005.
- E. Lyman, "Extending the Foreign Spent Fuel Acceptance Program: Policy and Implementation Issues," 26th International Meeting on Reduced Enrichment for Research and Test Reactors, IAEA, Vienna, Austria, November 2004.
- E. Lyman, "Using Bilateral Mechanisms to Strengthen Physical Protection Worldwide," 45th Annual Meeting of the Institute of Nuclear Materials Management, Orlando, FL, July 2004.
- E. Lyman, "The Congressional Attack on RERTR," 25th International Meeting on Reduced Enrichment for Research and Test Reactors, RERTR-2003, Chicago, IL, October 2003.
- E. Lyman, "Nuclear Plant Protection and the Homeland Security Mandate," 44th Annual Meeting of the Institute of Nuclear Materials Management, Phoenix, AZ, July 2003.

E. Lyman and A. Kuperman, "A Reevaluation of Physical Protection Standards for Irradiated HEU Fuel," 24th International Meeting on Reduced Enrichment for Research and Test Reactors, RERTR-2002, Bariloche, Argentina, November 2002.

E. Lyman, "Material Protection, Control and Accounting at the U.S. MOX Fuel Fabrication Plant: Merely an Afterthought?" 43rd Annual Meeting of the Institute of Nuclear Materials Management (INMM), Orlando, FL, June 2002.

E. Lyman, "Terrorism Threat and Nuclear Power: Recent Developments and Lessons to be Learned," Symposium on Rethinking Nuclear Energy and Democracy after 9/11, sponsored by PSR/IPPNW Switzerland, Basel, Switzerland, April 2002.

E. Lyman, remarks for Expert Panel on Advanced Reactors, Nuclear Safety Research Conference, U.S. Nuclear Regulatory Commission, Washington, DC, October 2001.

E. Lyman, "The Future of Immobilization Under the U.S.-Russian Plutonium Disposition Agreement," 42nd Annual Meeting of the Institute of Nuclear Materials Management (INMM), Indian Wells, CA, July 18, 2001.

E. Lyman, comments in *the Report of the Expert Panel on the Role and Direction of Nuclear Regulatory Research*, U.S. Nuclear Regulatory Commission, May 2001.

E. Lyman, "Can the Proliferation Risks of Nuclear Power be Made Acceptable?" Nuclear Control Institute 20th Anniversary Conference, Washington, DC, April 9, 2001.

E. Lyman and P. Leventhal, "Radiological Sabotage at Nuclear Power Plants: A Moving Target Set," 41st Annual Meeting of the INMM, New Orleans, LA, July 2000.

E. Lyman, "Comments on the Storage Criteria for the Storage and Disposal of Immobilized Plutonium," Proceedings of the Institute for Science and International Security Conference on "Civil Separated Plutonium Stocks --- Planning for the Future," March 14-15, 2000, Washington, DC, Isis Press, 135.

E. Lyman, "The Sea Shipment of Radioactive Materials: Safety and Environmental Concerns," Conference on Ultrahazardous Radioactive Cargo by Sea: Implications and Responses, sponsored by the Maritime Institute of Malaysia, Kuala Lumpur, Malaysia, October 1999.

E. Lyman, "A Critique of Physical Protection Standards for Irradiated Materials," 40th Annual Meeting of the INMM, Phoenix, AZ, July 1999.

E. Lyman, "DOE Reprocessing Policy and the Irreversibility of Plutonium Disposition," Proceedings of the 3rd Topical Meeting on DOE Spent Nuclear Fuel and Fissile Materials Management, American Nuclear Society, Charleston, SC, September 8-11, 1998, 149.

E. Lyman, "Japan's Plutonium Fuel Production Facility (PFPPF): A Case Study of the Challenges of Nuclear Materials Management," 39th Annual Meeting of the INMM, Naples, FL, July 1998.

E. Lyman, "Safety Aspects of Unirradiated MOX Fuel Transport," Annex 2b of the *Comprehensive Social Impact Assessment of MOX Use in Light Water Reactors*, Citizens' Nuclear Information Center, Tokyo, November 1997.

E. Lyman, "Unresolved Safety Issues in the Storage and Transport of Vitrified High-Level Nuclear Waste," 38th Annual Meeting of the INMM, Phoenix, AZ, July 1997.

E. Lyman, "A Perspective on the Proliferation Risks of Plutonium Mines," proceedings of the Plutonium Stabilization and Immobilization Workshop, U.S. Department of Energy, Washington, DC, December 12-14, 1995, CONF-951259, p, 445.

E. Lyman, "Assessing the Proliferation and Environmental Risks of Partitioning-Transmutation," Fifth International Summer Symposium on Science and World Affairs, Cambridge, MA, USA, July 1993.

Letters to the Editor and Op-Eds

E. Lyman, "Nuclear Cybersecurity: Why We Should Worry," New York Times, January 26, 2016.

E. Lyman and F. von Hippel, "Direct Disposal is a Better Solution for South Carolina's Plutonium Problem" (op-ed), Augusta Chronicle, October 24, 2015.

E. Lyman, "The Value of a Life," New York Times, February 23, 2011.

E. Lyman, "The Downside of Nuclear Energy," Washington Post, April 21, 2006.

E. Lyman, "Reprocessing Nuclear Waste: Forget It," Topeka Capital-Journal, December 24, 2005.

E. Lyman, "The Wrong Way to Get Cheap Electricity," Chicago Sun-Times, December 16, 2005.

E. Lyman, "Uranium on Campus," New York Times, August 23, 2004

L. Gronlund and E. Lyman, "Halting the Spread of Nuclear Arms," New York Times, December 28, 2003.

E. Lyman, "Troubles at Indian Point," New York Times, January 25, 2003.

E. Lyman and P. Leventhal, "Nonessential Nukes" (op-ed), Washington Post, November 26, 2002.

P. Leventhal and E. Lyman, "Shipping Plutonium," New York Times, July 12, 2002.

- E. Lyman, "Indian Point Reactor," New York Times, January 27, 2002.
- E. Lyman, "Spent Nuclear Fuel," New York Times, June 3, 2001.
- E. Lyman and P. Leventhal, "Better Plutonium Plan," New York Times, February 5, 1998.
- E. Lyman, "A Safer Plutonium Plan," Washington Post, August 24, 1997.
- P. Leventhal and E. Lyman, "Who Says Iraq Isn't Making a Bomb?" International Herald Tribune, November 2, 1995.
- H. Feiveson and E. Lyman, "No Solution to the Plutonium Problem," Washington Post, July 29, 1994.
- E. Lyman, "Getting Rid of Weapon Plutonium," *Bulletin of the Atomic Scientists*, July/August 1994.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE SECRETARY

In the Matter of)	
)	
Tennessee Valley Authority)	Docket No. 52-047-ESP
)	
(Clinch River Nuclear Site))	
)	

**DECLARATION OF DR. M.V. RAMANA IN SUPPORT OF
PETITIONERS' CONTENTION 3 (IMPERMISSIBLE DISCUSSION OF
ENERGY ALTERNATIVES AND TECHNICAL ADVANTAGES)**

Under penalty of perjury, M.V. Ramana declares as follows:

1. My name is M.V. Ramana. I am a Professor and the Simons Chair in Disarmament, Global and Human Security at the Liu Institute for Global Issues, University of British Columbia, Vancouver, Canada.
2. I am a qualified expert on matters relating to nuclear energy policy and economics. I have a Ph.D. in Theoretical Physics from Boston University and a M.Sc. in Physics from the Indian Institute of Technology, Kanpur, India. I have written many academic papers and articles on a wide range of topics relating to nuclear energy in various journals and magazines, including *Scientific American*, *Science and Global Security*, *Energy Policy*, *Nuclear Technology*, *Journal of Risk Research*, *Environmental Impact Assessment Review*, *Energy Research and Social Science*, and *International Journal of Global Energy Issues*. I have also been a member of many professional organizations relevant to my area of expertise, including the International Panel on Fissile Materials and the Science and Security Board of the Bulletin of the Atomic Scientists. A copy of my curriculum vitae is attached.
3. I am familiar with the licensing-related filings and correspondence that have been submitted by Tennessee Valley Authority ("TVA") in support of its application for an Early Site Permit for a Small Modular Reactor ("SMR") on the Clinch River Nuclear Site, particularly TVA's Environmental Report. I am also familiar with applicable regulations, policies, and guidance documents of the U.S. Nuclear Regulatory Commission ("NRC").
4. I am familiar with the history of development of nuclear technology in the United States, including the development and operation of light water reactors and the development of SMR designs. I am also familiar with the characteristics and costs of a range of technologies available or currently being developed for electricity generation,

including coal and gas based power plants; renewable energy sources such as solar and wind; and nuclear energy. I have researched and written papers on various technical and policy issues related to SMRs, including their technical characteristics, uranium fuel requirements and spent fuel generation, challenges with their licensing, conflicts between design priorities, and demand for them in developing countries.

5. I assisted Petitioners with the preparation of their Contention 3, which asserts that TVA has failed to comply with the National Environmental Policy Act (“NEPA”) and NRC implementing regulations in its evaluation of alternatives. The factual assertions in the contention are true and correct to the best of my knowledge, and the opinions expressed therein are based on my best professional judgment.

M. V. Ramana

M.V. Ramana, Ph.D.

June 8, 2017

CURRICULUM VITAE

M. V. Ramana
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Liu Institute for Global Issues
University of British Columbia

EMPLOYMENT

- | | |
|--|---|
| Simons Chair in Disarmament, Global and Human Security,
Liu Institute for Global Issues, University of British Columbia | January 2017 onwards |
| Professional Specialist, Program in Science and Global
Security, Princeton University
Researching issues related to nuclear power, nuclear
proliferation and climate change | July 2012 – December 2016 |
| Associate Research Scholar, Program in Science and Global
Security, Princeton University
Researching issues related to nuclear power, nuclear
proliferation and climate change | November 2009 – June 2012 |
| Lecturer, Woodrow Wilson School of Public and International
Affairs
Designed and taught courses related to energy, environment
and development, and nuclear power for Masters students and
Freshmen | March 2010 – May 2012, Fall
2013, Fall 2014, Spring 2016 |
| Visiting Research Scholar, Program in Science, Technology, and
Environmental Policy, Woodrow Wilson School of Public and
International Affairs, Princeton University
Researching issues related to nuclear power and climate change | May 2009 – November 2009 |
| Senior Fellow, Centre for Interdisciplinary Studies in
Environment and Development, Bangalore | April 2007 – April 2009 |
| Fellow, Centre for Interdisciplinary Studies in Environment
and Development, Bangalore
Researched economic and environmental aspects of India's nuclear energy program | April 2004 – April 2007 |
| Research Staff, Program on Science and Global Security,
Princeton University
Researched global nuclear disarmament and India's nuclear weapons and energy programs | September 2001 – March 2004 |
| Lecturer, Woodrow Wilson School of Public and International
Affairs, Princeton University
Lectured and conducted precepts for a course on Methods in Science, Technology, and Environmental
Policy | September 2001 – February
2002 |
| Lecturer, Yale Center for International and Area Studies, Yale
University
Designed and taught course on Science, Technology, and Development in India | August 2001 – December 2001 |
| Research Associate, Center for Energy and Environmental
Studies, Princeton University | September 1998 – August
2001 |

Conducted research on technical aspects of nuclear disarmament and India's nuclear weapons and energy programs; influence of scientists on nuclear policy

Lecturer, Woodrow Wilson School of Public and International Affairs, Princeton University February 1999 – July 1999
Gave lectures and conducted precepts for a course on Science, Technology, and Public Policy

Post-doctoral Fellow, Security Studies Program, Massachusetts Institute of Technology August 1996 – August 1998
Conducted research on technical aspects of nuclear weapons and disarmament, Indian ballistic missiles, and India's nuclear policy

Post-doctoral Fellow, Physics Department, University of Toronto September 1994 - July 1996
Conducted theoretical research on tests of particle physics models at accelerator experiments

Research Fellow, Physics Department, Boston University June 1989 – August 1994
Conducted research on phenomenological aspects of electroweak symmetry breaking

EDUCATION

Boston University, Ph.D., Physics, September 1994 Thesis Advisor: Kenneth D. Lane
Thesis Title: "Phenomenological Aspects of Electroweak Symmetry Breaking"

Indian Institute of Technology, Kanpur, M.Sc. Physics, May 1988

HONORS, AWARDS, PROFESSIONAL SERVICE

Distinguished Lecturer, Sigma Xi Society, 2016-17

Leo Szilard Award, American Physical Society, 2014

Member, International Panel on Fissile Materials, since 2005

Member, Science and Security Board of the Bulletin of Atomic Scientists, 2008-2014

Member, Editorial Board, *Energy Research and Social Science*, since 2015

Robert Jay Lifton Fellowship, John Jay College of Criminal Justice, City University of New York, 2005

Guggenheim Fellowship, 2003

Member, Selection Committee, Global Security and Cooperation Program, Social Sciences Research Council, 2000-01

MacArthur Foundation Research and Writing Grant, 1999

SSRC-MacArthur Fellowship for International Research on Peace and Security, 1999

SSRC-MacArthur Post-doctoral Fellowship on Peace and Security in a Changing World, 1996

National Talent Search Scholarship, 1981 -1988

Reviewed papers for several journals including *Science and Global Security*, *World Politics*, *Bulletin of the Atomic Scientists*, *Climate Policy*, *Energy Policy*, *Journal of Environment and Development*, *Sustainability*, *Global Environmental Change*, *Energy and Environmental Science*, *Social Science Journal*, *Environment, Development and Sustainability*, *Environmental Politics*, *Energy Research and Social Science*, *Journal of Risk Research*, *Economic and Political Weekly*, and *Energy for Sustainable Development*.

PUBLICATIONS

Refereed Publications

Journal Articles

Matthias Englert, Friederike Frieß, and M. V. Ramana, “Accident Scenarios Involving Pebble Bed High Temperature Reactors,” *Science and Global Security*, **25**, no. 1 (2017), 42-55.

M. V. Ramana, A. H. Nayyar, and Michael Schoeppner, “Nuclear High-level Waste Tank Explosions: Potential Causes and Impacts of a Hypothetical Accident at India’s Kalpakkam Reprocessing Plant,” *Science and Global Security*, **24**, no. 3 (2016), 174-203.

M. V. Ramana and Priscilla Agyapong, “Thinking Big? Ghana, Small Reactors, and Nuclear Power,” *Energy Research and Social Science*, **21** (2016), 101-113.

M. V. Ramana and Ali Ahmad, “Wishful Thinking and Real Problems: Small Modular Reactors, Planning Constraints, and Nuclear Power in Jordan,” *Energy Policy*, **93** (2016), 236–245.

Amy King and M. V. Ramana, “The China Syndrome? Nuclear Power Growth and Safety After Fukushima,” *Asian Perspective*, **39** (2015), 607-636.

M. V. Ramana and Ashwin K. Seshadri, “Negligence, Capture, and Dependence: Safety Regulation of the Design of India’s Prototype Fast Breeder Reactor,” *Journal of Risk Research*, **18**, no. 8 (2015), 1030-1050.

Benjamin Sovacool and M. V. Ramana, “Back to the Future: Small Modular Reactors, Nuclear Fantasies, and Symbolic Convergence,” *Science, Technology, and Human Values*, **40**, no. 1 (2015), 96-125.

M. V. Ramana and Zia Mian, “One Size Doesn't Fit All: Social Priorities and Technical Conflicts for Small Modular Reactors,” *Energy Research and Social Science* **2** (May 2014), 115-124.

Ali Ahmad and M. V. Ramana, “Too Costly to Matter: Economics of Nuclear Power for Saudi Arabia,” *Energy* **69** (May 2014), 682-694.

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M. V. Ramana and Ashwin Kumar, “‘One in Infinity’: Learning from Accidents and Lessons for Nuclear Safety in India,” *Journal of Risk Research* (2013), 23-42.

Alexander Glaser, Laura Berzak Hopkins, and M. V. Ramana, “Resource Requirements and Proliferation Risks Associated with Small Modular Reactors,” *Nuclear Technology* **184**, (October 2013), 121-129.

M. V. Ramana, “Shifting Strategies and Precarious Progress: Nuclear Waste Management in Canada,” *Energy Policy* **61**, (October 2013), 196-206.

M. V. Ramana and Eri Saikawa, “Choosing a Standard Reactor: International Competition and Domestic Politics in Chinese Nuclear Policy,” *Energy* **36** (2011), 6779-6789.

J. Y. Suchitra and M. V. Ramana, “The Costs of Power: Plutonium and the Economics of India’s Prototype Fast Breeder Reactor,” *International Journal of Global Energy Issues* **35**, no. 1 (2011), 1-23.

M. V. Ramana and Divya Badami Rao, “The Environmental Impact Assessment Process for Nuclear Facilities: An Examination of the Indian Experience,” *Environmental Impact Assessment Review* **30**, no. 4 (2010), 268-271.

- M. V. Ramana and Ashwin Kumar, “Least Cost Principles and Electricity Planning for Karnataka,” *Energy for Sustainable Development* **13**, no. 4 (2009), 225–234.
- M. V. Ramana and J. Y. Suchitra, “Slow and Stunted: Plutonium Accounting and the Growth of Fast Breeder Reactors in India,” *Energy Policy* **37**, no. 12 (2009), 5028-5036.
- M. V. Ramana “India and Fast Breeder Reactors,” *Science and Global Security* **17** (2009), 54-67.
- M. V. Ramana and Ashwin Kumar, “Compromising Safety: Design Choices and Severe Accident Possibilities in India's Prototype Fast Breeder Reactor,” *Science and Global Security* **16** (2008), 87-114.
- Alexander Glaser and M. V. Ramana, “Weapon-Grade Plutonium Production Potential in the Indian Prototype Fast Breeder Reactor,” *Science and Global Security* **15** (2007), 85-105.
- M. V. Ramana and J. Y. Suchitra, “Costing Plutonium: Economics of Reprocessing in India,” *International Journal of Global Energy Issues* **27**, no. 4 (2007), 454-471.
- Zia Mian, A. H. Nayyar, R. Rajaraman, and M. V. Ramana, “Fissile Materials in South Asia and the Implications of the U.S.-India Nuclear Deal,” with *Science and Global Security* **14** (2006), 117-143.
- M. V. Ramana, Antonette D'Sa, and Amulya Reddy, “Nuclear Energy Economics in India,” *Energy for Sustainable Development* **IX**, no. 2 (June 2005), 35-48.
- M. V. Ramana, “An Estimate of India’s Uranium Enrichment Capacity,” *Science and Global Security* **12** (2004), 115-124.
- Zia Mian, R. Rajaraman, and M. V. Ramana, “Early Warning in South Asia: Constraints and Implications,” *Science and Global Security* **11** (2003), 109–150.
- M. V. Ramana, Dennis Thomas, and Susy Varughese, “Estimating Nuclear Waste Production in India,” *Current Science* **81**, no. 11 (December 10, 2001), 1458-1462.
- Zia Mian, M. V. Ramana, and R. Rajaraman, “Plutonium Dispersion and Health Hazards from Nuclear Weapons Accidents,” *Current Science* **80**, no. 10 (May 25, 2001), 1275-1284.
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- M. V. Ramana, “Gauge Boson Scattering in a Hidden Symmetry Breaking Sector at $e+e-$ Colliders,” *Modern Physics Letters A* **11** (1996), 247-255.
- M. V. Ramana “Glueballs in Strongly Interacting Theories at the Electroweak Scale,” *Physics Letters* **B368** (1996), 215-220.
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- R. S. Chivukula, M. Golden, D. Kominis, and M. V. Ramana, “The Phenomenology of a Hidden Symmetry Breaking Sector,” *Physics Letters* **B293** (1992), 400-404.
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S Rajendran Pillai and M. V. Ramana, “Breeder reactors: A Possible Connection Between Metal Corrosion and a History of Sodium Leaks,” *Bulletin of the Atomic Scientists* **70**, no. 3 (May/June 2014), 49-55.

Zia Mian and M. V. Ramana, “Asian War Machines,” *Critical Asian Studies* **46**, no. 2 (June 2014), 345-360.

Ashwin Kumar and M. V. Ramana, “Nuclear Safety in India: Theoretical Perspectives and Empirical Evidence,” *OUCIP Journal of International Studies* **1**, no. 1 (July—December 2013), 49-72.

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Benjamin K. Sovacool, Patrick Parenteau, M. V. Ramana, Scott V. Valentine, Mark Z. Jacobson, Mark A. Delucchi, and Mark Diesendorf, “Comment on “Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power,”” *Environmental Science and Technology* **47**, (May 2013), 6715-6717.

Suvrat Raju and M. V. Ramana, “Cost of Electricity from the Jaitapur Nuclear Power Plant,” *Economic and Political Weekly* **XLVIII**, no. 26 & 27 (2013), 51-60.

M. V. Ramana, “Nuclear policy responses to Fukushima: Exit, Voice, and Loyalty,” *Bulletin of the Atomic Scientists* **69**, no. 2 (March/April 2013), 66-76.

M. V. Ramana, “Flunking Atomic Audits,” *Economic and Political Weekly* **XLVII**, no. 39 (2012), 10–13.

Ashwin Kumar and M. V. Ramana, “The Limits of Safety Analysis: Severe Nuclear Accident Possibilities at the PFBR,” *Economic and Political Weekly* **XLVI**, no. 43 (2011), 44-49.

M. V. Ramana, “Nuclear Power and the Public,” *Bulletin of the Atomic Scientists* **67**, no. 4 (July/August 2011), 43 -51.

Zia Mian and M. V. Ramana, “The Enduring Power of Mass Production, Mass Consumption, and Mass Destruction,” *Development* **54**, no. 2 (2011), 194-196.

Thomas Cochran, Harold Feiveson, Zia Mian, M. V. Ramana, Mycle Schneider, and Frank von Hippel, "It's Time to Give Up on Breeder Reactors," *Bulletin of the Atomic Scientists* **66**, no. 3, (May/June 2010), 50-56.

Suvrat Raju and M. V. Ramana, "The Other Side of Nuclear Liability," *Economic and Political Weekly*, **XLV**, no. 16, (April 17, 2010), 48-54.

M. V. Ramana and Ashwin Kumar, "Safety First? Kaiga and Other Nuclear Stories," *Economic and Political Weekly* **XLV**, no. 7 (2010), 47-54.

M. V. Ramana, "Nuclear Power: Economic, Safety, Health, and Environmental Issues of Near-Term Technologies," *Annual Review of Environment and Resources* **34** (2009), 127-52.

Divya Badami Rao and M. V. Ramana, "Violating Letter and Spirit: Environmental Clearances for Koodankulam Reactors," *Economic and Political Weekly* **XLIII**, no. 51 (December 20, 2008), 14-18.

Zia Mian and M. V. Ramana, "Going MAD: Ten Years of the Bomb in South Asia," *Economic and Political Weekly* **XLIII**, no. 26 and 27 (June 28, 2008), 201-208.

U. A. Shimray and M. V. Ramana, "Uranium Mining in Meghalaya: Simmering Problem," *Economic and Political Weekly* **XLII**, no. 52 (December 29, 2007), 13-17.

M. V. Ramana, "Heavy Subsidies in Heavy Water: Economics of Nuclear Power in India," *Economic and Political Weekly* **XLII**, no. 34 (August 25, 2007), 3483-3490.

M. V. Ramana, "Economics of Nuclear Power: Subsidies and Competitiveness," *Economic and Political Weekly* **XLII**, no. 2 (January 13, 2007), 169-171.

J. Y. Suchitra and M. V. Ramana, "High Costs, Questionable Benefits of Reprocessing," *Economic and Political Weekly* **XLI**, no. 47 (November 25, 2006), 4848-4851.

M. V. Ramana, "Twenty Years after Chernobyl: Debates and Lessons," *Economic and Political Weekly* **XLI**, no. 18 (May 6, 2006), 1743-1747.

J. Y. Suchitra and M. V. Ramana, "Nuclear Power: No Route to Energy Security," *Energy Security Insights* **I**, no. 1 (March 2006), 13-16.

Zia Mian and M. V. Ramana, "Wrong Ends, Means, and Needs: Behind the U.S. Nuclear Deal with India," *Arms Control Today* (January/February 2006), 11-17.

M. V. Ramana, "Tall Claim, Little Evidence," *Economic and Political Weekly* **XL**, no. 50 (December 10, 2005), 5237-5239.

M. V. Ramana, "Nuclear Power: Expensive and Unsafe," *Electrical India* **45**, no. 11 (November 2005), 1-11.

Zia Mian and M. V. Ramana, "Feeding the Nuclear Fire," *Economic and Political Weekly* **XL**, no. 35 (August 27, 2005), 3808-3812.

M. V. Ramana, Antonette D'Sa and Amulya Reddy, "Economics of Nuclear Power from Heavy Water Reactors," *Economic and Political Weekly* **XL**, no. 17 (April 23, 2005), 1763-1773.

M. V. Ramana, "India's Uranium Enrichment Program," *International Network of Engineers and Scientists Against Proliferation Bulletin* **24** (December 2004), 71-74.

M. V. Ramana, "Scientists, Nuclear Weapons, and the Peace Movement," *Economic and Political Weekly* **XXXIX**, no. 46-47 (November 20, 2004), 5013-5016.

Zia Mian, A. H. Nayyar, and M. V. Ramana, "Making Weapons, Talking Peace: Resolving Dilemma of Nuclear Negotiations," *Economic and Political Weekly* **XXXIX**, no. 29 (July 17, 2004), 3221-3224.

M. V. Ramana, R. Rajaraman and Zia Mian, “Nuclear Early Warning in South Asia: Problems and Issues,” *Economic and Political Weekly* **XXXIX**, no. 3 (January 17, 2004), 279-284.

M. V. Ramana, “Scientists, Nuclear Weapons and Peace in India,” *International Network of Engineers and Scientists Against Proliferation Bulletin* **22** (December 2003), 25-27.

M. V. Ramana, “A Stepping Stone to a Fully Nuclear Future,” *Science and Global Security* **11** (2003), 81-83.

M. V. Ramana, “Risks of a LOW Doctrine,” *Economic and Political Weekly* **XXXVIII**, no. 9 (March 1, 2003), 860-864.

R. Rajaraman, M. V. Ramana, and Zia Mian, “Possession and Deployment of Nuclear Weapons in South Asia: An Assessment of Some Risks,” *Economic and Political Weekly* **XXXVII**, no. 25 (June 22, 2002), 2459-65.

M. V. Ramana and A. H. Nayyar, “India, Pakistan and the Bomb” *Scientific American* (December 2001), 73-83.

M. V. Ramana, “South Asian Mode of Weaponisation,” *Economic and Political Weekly* **XXXV**, no. 11 (March 11, 2000), 896-897.

M. V. Ramana, “Reinventing the Arms Race,” *FORUM for Applied Research and Public Policy* **14**, no. 2 (Summer 1999), 1-6.

Zia Mian and M. V. Ramana, “Disarmament Judo: Using the NPT to make the Nuclear-Weapon States Negotiate the Abolition of Nuclear Weapons,” with Zia Mian, *Disarmament Diplomacy* **36** (April 1999), 1-4.

Zia Mian and M. V. Ramana, “Beyond Lahore: From Transparency to Arms Control,” *Economic and Political Weekly* **XXXIV**, no. 16-17 (17 April 1999), 938-942.

M. V. Ramana, “India's Nuclear Program: From 1946 to 1998,” *International Network of Engineers and Scientists Against Proliferation Bulletin* **16** (November 1998), 8-9.

Zia Mian and M. V. Ramana, “Stepping Away from the Nuclear Abyss: Some Proposals,” *International Network of Engineers and Scientists Against Proliferation Bulletin* **16** (November 1998), 12-14.

M. V. Ramana, “Effects of a Nuclear Blast over Bombay,” *Medicine and Global Survival* **5**, no. 2 (October 1998), 74-77.

M. V. Ramana, “Do Nuclear Weapons provide Security?” *Seminar* **468** (August 1998), 50-54.

M. V. Ramana, “The Hawks take Flight: India and the Fissile Material Cutoff,” *International Network of Engineers and Scientists Against Proliferation Bulletin* **13** (July 1997), 10-12.

Reports and Chapters in Reports

Bernadette K. Cogswell, Nataliawati Siahaan, Friga Siera R, M. V. Ramana, and Richard Tanter, *Nuclear Power and Small Modular Reactors in Indonesia: Potential and Challenges*, Indonesian Institute for Energy Economics and Nautilus Institute for Security and Sustainability, April 2017

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M. V. Ramana, “Bangladesh,” “China,” “Jordan,” “India,” “Pakistan,” and “United States,” in Mycle Schneider and Antony Froggatt, *The World Nuclear Industry Status Report 2016*, Mycle Schneider Consulting, Paris (July 2016), 43-44, 50-53, 125-148, 162-163.

M. V. Ramana and Frank von Hippel, eds., *Plutonium Separation in Nuclear Power Programs: Status, Problems, and Prospects of Civilian Reprocessing Around the World*, International Panel on Fissile Materials, Princeton (July 2015), 2-178.

Contribution: Report Design: 30%; Writing: 50%; Editing: 50%; Production: 80%

M. V. Ramana, “India” in M. V. Ramana and Frank von Hippel, eds., *Plutonium Separation in Nuclear Power Programs: Status, Problems, and Prospects of Civilian Reprocessing Around the World*, International Panel on Fissile Materials, Princeton (July 2015), 52-61.

Alexander Glaser, M. V. Ramana, Ali Ahmad, and Robert Socolow, “Small Modular Reactors: A Window on Nuclear Energy,” An Energy Technology Distillate from the Andlinger Center for Energy and the Environment at Princeton University (June 2015), 3-27.

M. V. Ramana, “Advanced Nuclear Reactors—The Story of the SMR,” in Mycle Schneider and Antony Froggatt, *The World Nuclear Industry Status Report 2015*, Mycle Schneider Consulting, Paris (July 2015), 68-77.

M. V. Ramana, “India,” in Ray Acheson, ed., *Assuring Destruction Forever: 2015 Edition*, Reaching Critical Will, New York (2015), 38-43.

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M. V. Ramana, “Modernizing India’s Nuclear Arsenal,” in Ray Acheson, ed., *Assuring Destruction Forever: Nuclear Weapon Modernization Around the World*, Reaching Critical Will, New York (2012), 34-43.

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M. V. Ramana, “India,” in *Global Fissile Material Report 2010: Balancing the Books: Production and Stocks*, International Panel on Fissile Materials, Princeton (2010), 117-125.

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M. V. Ramana, “India: A Nuclear Update,” Greenpeace Report (May 2003), 1-4.

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Zia Mian, M. V. Ramana, and R. Rajaraman, “Risks and Consequences of Nuclear Weapons Accidents in South Asia,” Princeton University/Center for Energy and Environmental Studies Report no. 326 (September 2000), 1-34.

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- “Nuclear Energy in Saudi Arabia: Necessary? Economically Competitive?,” Presentation at NPEC Public Policy Fellowship Retreat, Nonproliferation Policy Education Center, Washington, D.C., March 4, 2017
- “Linkages Between Nuclear Energy and Nuclear Weapons,” Presentation (over Skype) at Workshop on The Nuclear-Climate Nexus and Sustainable Peace, International Peace Bureau World Congress, Berlin, October 1, 2016
- “Emerging Reactor and Fuel Cycle Technologies, Including Associated Safety, Security, and Safeguards Risks,” Presentation at Workshop on Managing Risks Associated with Global Nuclear Energy Expansion: Emerging Challenges and Cooperative Solutions, George Washington University, Washington, D. C., May 5, 2016
- “Reprocessing and Breeder Reactors: The Case of India,” Presentation at Meeting of the International Panel on Fissile Materials, American Association for the Advancement of Science, Washington, D. C., March 14-15, 2016
- “Ethical Concerns Regarding Nuclear Energy: Weapons, Accidents, Wastes, Costs, and Democracy,” Workshop on Ethics and Governance of Energy Technologies, Eindhoven University of Technology, Netherlands, January 15, 2016
- Co-convenor, Working Group on “Civilian Nuclear Energy, Energy Resources, and International Cooperation,” 61st Pugwash Conference on Science & World Affairs, Nagasaki, Japan, November 1-5, 2015
- “Small Modular Reactors in the United States,” Workshop on Nuclear Power And Small Modular Reactors In Indonesia: Potential And Challenges, Indonesian Institute of Energy Economics, Jakarta, June 25, 2015
- “The Challenges of Nuclear Safety,” International Workshop on Emerging Energy Scenarios in the Middle East, Munib and Angela Masri Institute of Energy and Natural Resources, American University, Beirut, May 22, 2015
- “Accident Risks for High Temperature Reactors,” 1st International Conference on Nuclear Risks, Vienna, April 16-17, 2015
- “Taking Sides on the ‘Double Movement’,” Polanyi Conference on Science and Social Responsibility, University of Toronto, November 15, 2014
- “Nuclear Power in Today’s Energy and Environmental Discourse,” Workshop on New Studies in Ecology and Environment, New Delhi, India, August 23, 2014
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- “The Impact of Fukushima and Chernobyl on India’s Anti-Nuclear Movements,” Conference on Traveling Norms and the Politics of Contention, Zurich, Switzerland, October 25, 2013
- “Small Modular Reactors: Uranium Resource Requirements, Waste Generation and Proliferation Risk Assessment,” Presentation at the 21st International Conference on Nuclear Engineering, Chengdu, China, July 29-August 2, 2013
- “Fukushima Nuclear Accident: Shortcomings of Safety Regulation and Lessons Learned,” Panel Discussion at the Carnegie International Nuclear Policy Conference, Washington, D.C., April 8, 2013
- “Whither Nuclear Power?” Panel Discussion at the Carnegie International Nuclear Policy Conference, Washington, D.C., April 8, 2013
- “‘One in infinity’: Assessing Nuclear Risks in India,” Presentation at the Panel on “India at Risk: Capacity, Institutions and Expertise”, Society for Risk Analysis 2012 Annual Meeting, San Francisco, December 12, 2012
- “How about Domestic Emission Inequities? The Case of India,” Presentation at the International Conference on Inequality and Sustainability, Stockholm Environmental Institute & Center for International Environment and Resource Policy, Boston, November 9, 2012
- “Proliferation Risks Associated with Small Modular Reactors,” Presentation at the “Summer Symposium on Science and World Affairs”, Organized by the Union of Concerned Scientists, Princeton, July 9, 2012
- “India and Nuclear Transparency,” Presentation at the Workshop on “Transparency”, Organized by the International Panel on Fissile Materials, Princeton, March 31, 2012
- “Nuclear Safety and Security in India,” Presentation at the Panel Discussion on Nuclear Policy of Key Countries, Seoul National University, Seoul, South Korea, March 22, 2012
- “Indian Fallout: Public Protest and Organizational Strategies in the Aftermath of the Fukushima Accidents,” Presentation at Panel Discussion on Nuclear Energy After Fukushima: Japan and Beyond, Association of Asian Studies Conference, Toronto, March 18, 2012
- “Nuclear Power in India: Implications of Fukushima,” Presentation at the Panel on Nuclear Power: One Year after Fukushima, American Physical Society Meeting, Boston, March 1, 2012
- “India’s Nuclear Plans: Can they be Realized?,” Presentation at the Workshop on “Reprocessing”, Organized by the International Panel on Fissile Materials, Tokyo, January 20, 2012
- “Prospects for India’s Breeder Program,” Presentation at the Workshop on “Nuclear Fuel Cycle Issues in Asia”, Organized by the International Panel on Fissile Materials, Tokyo, March 19, 2010
- “Inherently Ambiguous? The Limits of Nuclear Accident Scenarios and Safety Analyses,” Meeting on “Knowledge Society Debates”, Organized by the STEPS Centre, University of Sussex, National Institute of Advanced Studies, Bangalore, January 8, 2009
- “Some Challenges for Nuclear Power in Developing Countries,” Presentation at Conference on “New Generation Nuclear: From policy to implementation,” Organized by Chatham House, London, November 17-18, 2008

- “Nuclear Power in India: Perspectives and Challenges,” Presentation at Conference on “The nuclear energy revival: regional perspectives and governance challenges,” Organized by Centre for International Governance Innovation & Canadian Centre for Treaty Compliance, Waterloo, November 6-7, 2008
- “More than Desirable: Some Necessary, but not Sufficient, Conditions for Nuclear Expansion,” Presentation at the Conference on The Future of Nuclear Energy, Organized by the Bulletin of the Atomic Scientists, Argonne National Laboratory, and the University of Chicago, Chicago, September 25-26, 2008
- “Nuclear Power and Energy Security in India,” Presentation at Meeting on “The Proposal for Nuclear Trade with India,” Organized by Heinrich Böll Foundation and Arms Control Association, Berlin, May 13, 2008
- “Some Implications of the US-India Nuclear Deal,” Presentation at the NGO Panel on “The US-India Nuclear Deal and the NPT,” Nuclear Non Proliferation Treaty Preparatory Committee Meeting, United Nations, Geneva, May 2, 2008
- “Fissile Material Implications of the US-India Nuclear Deal,” Presentation at the Annual Meeting of the German Physical Society, Berlin, February 29, 2008
- “Nuclear Safety,” Presentation at the Centre for Interdisciplinary Studies on Environment and Development Advisory Committee Meeting, Bangalore, January 11, 2008
- “Climate Change and Nuclear Power in Developing Countries,” Presentation at “Nuclear Energy: Myth and Reality,” Side event at 13th Conference of Parties to the United Nations Framework Convention on Climate Change, Organized by Heinrich Böll Foundation, Nusa Dua, Bali, December 13, 2007
- “Infeasible and Undesirable: A Nuclear Comeback and Climate Security,” Presentation at 2nd TERI-KAF Conference on “Energy, Climate, and Security: The Inter-Linkages,” Organized by The Energy and Resources Institute and Konrad Adaneur Foundation, Goa, October 13 - 14, 2007
- “Nuclear Reactors: Unsafe at any Price,” Presentation at the International Conference on “Indo-US Nuclear Deal,” Organized by the Heinrich Böll Foundation, CNDP, and PEACE, New Delhi, August 31-September 1, 2007
- “The U.S. India Nuclear Deal: Debates and Implications,” Presentation at the Meeting on “Forging a New Consensus for the NPT,” Article VI Forum, Vienna International Center, Vienna, March 29, 2007
- “Nuclear Energy: Projections and Economics,” Presentation at Workshop on Power Sector Reforms and Regulation in India, Prayas, Pune, March 22-23, 2007
- “Economic and Environmental Costs of Nuclear Power,” Presentation at the Ninth Biennial Conference of the International Society of Ecological Economics, New Delhi, December 16-18, 2006
- “Nuclear Economics in a Developing Country: The Case of India,” Presentation at the Conference on The Future of Nuclear Energy, Organized by the Bulletin of the Atomic Scientists, Argonne National Laboratory, and the University of Chicago, Chicago, November 1-2, 2006
- “Nuclear Energy and Climate Change,” Presentation at the Workshop for Journalists on Energy and Climate Change, Organized by PANOS South Asia, New Delhi, July 5, 2006
- “Feeding the Nuclear Fire,” Presentation at the Conference on International Nuclear Cooperation with India, Simons Centre for Disarmament, University of British Columbia, Vancouver, November 22, 2005

- “India’s Nuclear Enclave and the Practice of Secrecy,” Presentation at the Second Workshop on “Culture, Society and Nuclear weapons in South Asia,” Social Science Research Council, Washington, D.C., August 28-29, 2005
- “An Estimate of India’s Uranium Enrichment Capacity,” Presentation at the 17th International Summer Symposium on Science and World Affairs, Princeton, July 23-31, 2005
- Discussant, First Workshop on “Culture, Society and Nuclear weapons in South Asia,” Social Science Research Council, Amsterdam, May 9-11, 2005
- “Nuclear Power: the Department of Atomic Energy’s Plans and Constraints,” Presentation at the Consultation Meeting on Strategies to Realize a Non-nuclear India organized by Citizens for Alternatives to Nuclear Energy and Centre for Interdisciplinary Studies in Environment and Development, Bangalore, January 29, 2005
- Coordinator, Environmental Sustainability Group, Workshop on “Neglected Dimensions of Electricity Sector Policies: Equity, Sustainability, and Institutions and Governance,” Prayas, Pune, January 11-12, 2005
- “India and Nuclear Secrecy,” Presentation at the Conference on “Transparency as a Pre-requisite of Arms Control,” Peace Research Institute, Bensheim, November 19-20, 2004
- “Nuclear Energy and Security,” Presentation at the Workshop on “The Challenge of Hiroshima: Alternatives to Nuclear Weapons, Missiles, Missile Defenses, and Space Weaponization in a Northeast Asian Context,” International Network of Engineers and Scientists Against Nuclear Weapons, Hiroshima, October 8-11, 2004
- “Energy and Environmental Sustainability,” Presentation at the National Seminar on Integrating Environmental Sustainability with Economic Development, Maharani’s Arts College for Women, Bangalore, August 26, 2004
- “The Cost of Electricity from Indian Pressurised Heavy Water Reactors,” Presentation at the Centre for Interdisciplinary Studies on Environment and Development Advisory Committee Meeting, Bangalore, January 12, 2004
- “Effects of Nuclear Explosions,” Lecture at the Workshop on “Defence, Technology and Cooperative Security in South Asia”, Regional Centre for Strategic Studies, Shanghai, December 3-13, 2003
- “Problems with Nuclear Early Warning Systems in South Asia,” Lecture at the Workshop on “Defence, Technology and Cooperative Security in South Asia”, Regional Centre for Strategic Studies, Shanghai, December 3-13, 2003
- “Nuclear Weapons Effects,” Presentation at the Institute for Energy and Environmental Research Technical Training Workshop, Takoma Park, Maryland, June 19, 2003
- “Nuclear South Asia,” Talk at Panel on “War and Public Health,” Presentation at the American Public Health Association 130th Annual Meeting & Exposition, Philadelphia, November 11, 2002
- “Under the Nuclear Shadow,” Discussion at Middlesex County College, October 31, 2002
- “Dangers of Nuclear War and Paths to Nuclear Weapons Abolition,” Presentation at the American Friends Service Committee Conference on “Paths to a Just and Secure Future,” Boston, October 11, 2002
- “Nuclear South Asia,” Overview Lecture at the 1st International Professional Meeting of Independent Technical Security Analysts, Chicago, July 23-24, 2002

- Invited “Shadow Expert” at the SANITY (Students Against Nuclear Insanity and for Tomorrow’s Youth) Youth Caucus at the Nuclear Non Proliferation Treaty Preparatory Committee Meeting, United Nations, New York, April 17, 2002
- “The Arms Race in South Asia,” Presentation at the NGO Panel on “The Shape of Things to Come,” Nuclear Non Proliferation Treaty Preparatory Committee Meeting, United Nations, New York, April 12, 2002
- “Alternatives to Missile Defense,” Briefing for Delegates, NGOs and Press at the Nuclear Non Proliferation Treaty Preparatory Committee Meeting, United Nations, New York, April 11, 2002
- “Effects of Nuclear Explosions and Nuclear War in South Asia,” Lecture at the Workshop on “Defence, Technology and Cooperative Security in South Asia”, Regional Centre for Strategic Studies, Kalutara, Sri Lanka, January 5-14, 2002
- “Plutonium Dispersal and Health Hazards from Nuclear Weapon Accidents,” Lecture at the Workshop on “Defence, Technology and Cooperative Security in South Asia”, Regional Centre for Strategic Studies, Kalutara, Sri Lanka, January 5-14, 2002
- “Beyond Missile Defense: Arguments,” Presentation at the 13th International Summer Symposium on Science and World Affairs, Berlin, July 21-30, 2001
- “The Missile Race in Critical Regions: Is there a way out?,” Presentation at the Workshop on “Moving Beyond Missile Defense”, International Network of Engineers and Scientists Against Nuclear Weapons, Santa Barbara, March 19-21, 2001
- “Is there a Missile Threat? The Dynamics of Missile Proliferation and the State of Missile Control,” Presentation at the Workshop on “Moving Beyond Missile Defense”, International Network of Engineers and Scientists Against Nuclear Weapons, Santa Barbara, March 19-21, 2001
- “Ballistic Missile Disarmament,” Presentation at the Panel on “Outer Space: Disarmament Issues,” Organized by the NGO Committee on Disarmament, Disarmament Week, United Nations, October 19, 2000
- “Why Nuclear Disarmament,” Presentation at the Alliance for Nuclear Accountability Meeting, Amarillo, September 23, 2000
- “Plutonium Dispersion and Health Hazards from Nuclear Weapons Accidents,” Presentation at the 12th International Summer Symposium on Science and World Affairs, Moscow, Russia, August 23-31, 2000
- “Scientists and Radiation Protection: A History,” Presentation at the NGO Panel on “Health, Environment, Science and Society: Professional Responsibility in the Nuclear Age,” Nuclear Non-Proliferation Treaty Review Conference, United Nations, New York, May 15, 2000
- “Environmental Aspects of the Nuclear Fuel Cycle,” Presentation at the NGO Panel on “The Toxic Legacy of the Nuclear Age,” Nuclear Non-Proliferation Treaty Review Conference, United Nations, New York, May 4, 2000
- “Scientists and Ideology,” Presentation at the NGO Panel on “Personal Responsibility in the Nuclear Age,” Nuclear Non-Proliferation Treaty Review Conference, United Nations, New York, May 1, 2000
- “NPT Forecast: Cloudy or Sunny,” Presentation at the NGO Presentation in preparation for the Nuclear Non-Proliferation Treaty Review Conference, United Nations, New York, April 18, 2000
- “The Future of Post-Nuclear South Asia,” Presentation at the Conference on “Rethinking the Past, Shaping the Future: Partition, History and Identity,” South Asian Students Association of Smith College, Northampton, MA, March 25, 2000

- Overview presentation at the workshop (jointly organized with Srirupa Roy, New York University) on “Nuclear Understandings: Science, Society, and the Bomb in South Asia,” Dhaka, February 17, 2000
- Overview presentation at plenary discussion on “Nuclear Policy and Understandings in India” at the 13th Annual SSRC-MacArthur Foundation Fellows' The Conference, New Delhi, August 19-23, 1999
- “Health Effects of Reactor Accidents,” Presentation at the 11th International Summer Symposium on Science and World Affairs, Shanghai, China, July 28 - August 5, 1999
- “Regional Proliferation,” NGO Presentation at the Nuclear Non Proliferation Treaty Preparatory Committee Meeting, United Nations, New York, May 10-21, 1999
- “Nuclear Capabilities of India,” Presentation at the session on “Physics and Disarmament” at the 63rd Annual Meeting of the German Physical Society, Heidelberg, March 18, 1999
- Keynote Speaker, Symposium on De-alerting of Nuclear Weapons, Organized by The United Nations Department of Disarmament Affairs, New York, October 26, 1998
- “Radioactivity Releases from Underground Nuclear Tests,” Presentation at the 10th International Summer Symposium on Science and World Affairs, Cambridge, Massachusetts, USA, July 13-21, 1998
- “India's Nuclear Tests: Some Technical Aspects,” Presentation at the 10th International Summer Symposium on Science and World Affairs, Cambridge, Massachusetts, USA, July 13-21, 1998
- “Effects of a Nuclear Explosion,” Presentation at the Institute for Energy and Environmental Research Technical Training Workshop, Takoma Park, Maryland, July 7-12, 1998
- Discussant, Panel Discussion on “India, Pakistan and Global Nuclear Disarmament,” Sponsored by Congresswoman Barbara Lee and Congressman John Conyers and the Institute for Policy Studies, Rayburn House Office Building, Washington, D.C., June 25, 1998
- “India's Nuclear Tests,” Presentation at the 12th Annual SSRC-MacArthur Foundation Fellows' Conference, San Salvador, May 17-23, 1998
- Invited Specialist to discuss “Agreements on controlling the components: a fissile material cut-off” at the International Consultation on “Global Security and Nuclear Disarmament” organized by the United Services Institution, Delhi and the Oxford Research Group, U.K., Neemrana, March 3-6, 1998.
- “Serving a Nuclear Summons: How to make the Nuclear Weapon States Negotiate Disarmament,” Presentation at the Pugwash Workshop on “Eliminating Nuclear Weapons,” New Delhi, March 1-3, 1998
- Participant, Meeting on “The Future of Russian-US Strategic Arms Reductions: START III and Beyond,” Jointly sponsored by The Center for Arms Control, Energy, and Environmental Studies, The Moscow Institute of Physics and Technology, and The MIT Security Studies Program, Cambridge, USA, February 2-6, 1998
- “Modelling Prithvi and Agni,” Presentation at the 9th International Summer Symposium on Science and World Affairs, Cornell University, Ithaca, USA, July 24 -August 3, 1997
- Participant, Conference on “The Future of Nuclear Weapons : A US-India Dialogue,” Center for Advanced Study of India, University of Pennsylvania, May 5-8, 1997
- “Nuclear Energy in India: Problems and Prospects,” Presentation at the NGO sessions of the NPT Preparatory Conference, United Nations, New York, USA, April 15, 1997

- “The Effects of Nuclear Explosions - a Case Study of Mumbai,” Presentation at the Regional Meeting of the International Physicians for the Prevention of Nuclear War, New Delhi, India, February 21-23, 1997
- “History of the Comprehensive Test Ban Treaty,” Overview Presentation at Panel Discussion on South Asia and the CTBT, Massachusetts Institute of Technology, USA, September 24, 1997
- “India's Participation in a Fissile Material Production Cutoff Convention,” Presentation at the 8th International Summer Symposium on Science and World Affairs, Beijing, China, July 23-31, 1996
- “India's Participation in a Fissile Material Production Cutoff Convention” Presentation at the 10th Annual SSRC-MacArthur Foundation Fellows' Conference, Oxford University, United Kingdom, May 18-23, 1996
- “New Flavor Physics in b Decays,” Presentation at the 2nd Workshop on High Energy Physics Phenomenology, SN Bose Institute, Calcutta, January 1996
- “A New Physics Source of Hard Gluons in Top Quark Production,” Presentation at the 17th Annual MRST Meeting on High Energy Physics, Rochester, NY, USA, May 8-9, 1995
- Participant, Theoretical Advanced Study Institute in Elementary Particle Physics, Boulder, Colorado, USA, June 2-28, 1991

INVITED SEMINARS AND LECTURES

- “The Nuclear Arms Race in South Asia: The Case of India,” Lecture in Course on Weapons of Mass Destruction and International Security, Princeton University, Princeton, April 10, 2017
- “Why do States Build Nuclear Weapons? The Case of India,” Carleton College, MN, November 4, 2016
- “Nuclear Power: Overview, Economics, and India,” Carleton College, MN, November 4, 2016
- “Small Modular Reactors: An Inadequate Response to the Challenges Faced by Nuclear Power,” Nanyang Technological University, Singapore, October 18, 2016
- “U.S. Launch of the World Nuclear Industry Status Report 2016,” with Mycle Schneider, Natural Resources Defense Council, Washington, D.C., September 19, 2016
- “After Fukushima: Nuclear Power Programs Around the World,” Google Hangout with Sigma Xi, October 11, 2016
- “Nuclear Weapons in South Asia: Programmes, Plans, and Dangers,” Dr. Asghar Ali Engineer Memorial Advisory Committee and Coalition for Nuclear Disarmament and Peace, Mumbai, August 27, 2016
- “The Future of Nuclear Energy in India: Expectations and Constraints,” School of Media and Cultural Studies, Tata Institute of Social Sciences, Mumbai, August 26, 2016
- “Understanding Nuclear Energy and Nuclear Diplomacy,” Asian College of Journalism, Chennai, August 22, 2016
- “Whither Nuclear Power in the Middle East: The Cases of Saudi Arabia and Jordan,” Nonproliferation Policy Education Center, Washington, D.C., May 5, 2016
- “Connections Between Nuclear Energy and Nuclear Weapons,” Liu Institute for Global Issues, University of British Columbia, Vancouver, January 8, 2016
- “Exit, Voice, and Loyalty: Policy Choices and the Future of Nuclear Energy since Fukushima,” Liu Institute for Global Issues, University of British Columbia, Vancouver, January 7, 2016
- “Nuclear Power and India’s Energy Needs: Lessons from History,” Energy Policy Institute at the University of Chicago- India Centre, New Delhi, December 23, 2015
- “Status of nuclear power in India and the potential impact of India- Japan nuclear cooperation,” Citizens’ Nuclear Information Center, Tokyo, November 6, 2015
- “Nuclear Energy in China and India: Can Ambitions Meet Reality?” Kyoto University, Kyoto, November 4, 2015
- “Assessing Risk Assessment: Nuclear Regulation and Reactor Safety,” Princeton Institute for International and Regional Studies, Princeton University, Princeton, October 15, 2015
- “Nuclear Fission Energy: Status and Policies,” ExxonMobil – Princeton University Workshop, Princeton, October 13, 2015
- “Nuclear India: Politics, Rhetoric and Reality,” The Alliance for a Secular and Democratic South Asia & Science for the People, Massachusetts Institute of Technology, Cambridge, October 5, 2015
- “Challenges in Licensing Small Modular Reactors,” Bapeten (Nuclear Energy Regulatory Agency of Indonesia), Jakarta, June 26, 2015

- “Reprocessing and Breeder Reactors in India,” International Panel on Fissile Materials Panel on the Global Challenge of Reprocessing and Plutonium Disposal, NPT Review Conference, United Nations, New York, May 7, 2015
- “Nuclear Energy: Global Overview & the Case of India,” Program on International Relations and Strategic Affairs, Princeton University & Center for Policy Research, Princeton, April 9, 2015
- “Atomic Development and Democratic Dissent: Opposition to the Koodankulam Nuclear Plant in India,” Lecture, Program for South Asian Studies, Princeton University, Princeton, March 4, 2015
- “Nuclear Energy After Fukushima,” Colloquium, Department of Physics, Ohio State University, February 23, 2015
- “Nuclear Energy in India: Current Status and Future Outlook,” Korea Advanced Institute of Science and Technology, Daejeon, December 22, 2014
- “Nuclear Energy in India: Historical Record and Future Prospects,” Institute of South Asian Studies, National University of Singapore, August 19, 2014
- “Nuclear Power in India: History and Prospects,” Melbourne University, August 15, 2014
- “Motivations and Challenges for Small Modular Reactors,” Nuclear Engineering Department, Universidade Federal do Rio de Janeiro, March 18, 2014
- “The Power of Promise: Examining the Feasibility of a Rapid Expansion of Nuclear Energy in India,” South Asia Institute and the Kennedy School Project on Managing the Atom, Harvard University, Cambridge, December 6, 2013
- “Fukushima: Implications for the Understanding of Severe Accidents and the Future of Nuclear Energy,” Colloquium, Department of Physics, Case Western University, Cleveland, November 21, 2013
- “Nuclear Energy: Issues in India and Around the World,” Presentation at Prayas Energy Group, Pune, November 1, 2013
- “Challenges in Licensing Small Modular Reactors,” Trilateral Meeting, University of Maryland, College Park, September 19-20, 2013
- “Nuclear Energy and Climate Change,” Presentation at the Heinrich Böll Foundation, Beijing, August 6, 2013
- “Nuclear Power: Why, What, Why Not,” Lecture, Vermont Law School, South Royalton, July 12, 2013
- “Nuclear Arms Race in South Asia: The Case of India,” Lecture at the Heinrich Böll Foundation, Berlin, April 29, 2013
- “The Future of Nuclear Energy in India: History, Technology, and Economics,” Program in South Asia Studies, Princeton University, Princeton, March 28, 2013
- “Nuclear Energy in India: History, Technology, and the Future,” King’s College London, March 20, 2013
- “The Potential for Severe Accidents Associated with Nuclear Power,” Round Table on Liability Legislation in India, New Delhi, March 17, 2013 (over Skype)
- “Nuclear Energy in India: Learning from the Past, Thinking about the Future,” Indian Institute of Technology, Madras, February 22, 2013
- “The Power of Promise,” Jawaharlal Nehru University, New Delhi, February 20, 2013

- “Risk Perception in the Indian Nuclear Establishment,” The Energy and Resources Institute (TERI), New Delhi, February 20, 2013
- “Nuclear Power: Motivations and Problems,” National Institute of Immunology, New Delhi, February 19, 2013
- “Nuclear Energy in India: Perspectives on its Past, Present and Future,” Madras Institute of Development Studies, Madras, February 18, 2013
- Is Nuclear Energy the Answer to India's energy needs? Loyola College, Madras, February 18, 2013
- “Nuclear Accidents and Learning: The Indian Experience,” National Institute of Advanced Studies, Bangalore, February 15, 2013
- “Nuclear Energy in India: Past and Future,” Indian Institute of Management, Bangalore, February 14, 2013
- “Nuclear Energy in India: Perspectives on its Past, Present and Future,” Hyderabad Central University, Hyderabad, February 13, 2013
- “Nuclear Energy in India,” Panel Discussion at Lamakaan: An Open Cultural Space, Hyderabad, February 12, 2013
- “Worried in Koodankulam: Nuclear Safety and Public Protests in India,” Lecture at the San Jose Peace and Justice Center, San Jose, December 22, 2012
- “Organizing for Nuclear Disarmament and Peace in India,” Hiroshima/Nagasaki Commemoration, Coalition for Peace Action, Princeton, August 6, 2012
- “Small Modular Reactors: Features, Motivations,” Exploring the End of Nuclear Power and Examining its Proliferation and Health Problems, Institute for Energy and Environmental Research, Washington, D.C., July 25, 2012
- “Connections Between Nuclear Power and Nuclear Weapons: Production,” Exploring the End of Nuclear Power and Examining its Proliferation and Health Problems, Institute for Energy and Environmental Research, Washington, D.C., July 25, 2012
- “Nuclear Power: Why, What, Why Not,” Lecture, Vermont Law School, South Royalton, July 13, 2012
- “Small Modular Reactors: Overview,” Seminar at the Brookhaven National Laboratory, Upton, New York, May 9, 2012
- “Nuclear Power After Fukushima,” Colloquium, Department of Mathematical Sciences, Montclair State University, Montclair, New Jersey, November 30, 2011
- “The Future of Nuclear Power” Fall 2011 Maclean House Lecture Series, Sponsored by the Office of the Alumni Association, Princeton University, Princeton, October 6, 13, & 20, 2011
- “The Economics of Nuclear Power,” Seminar at the Indian Institute of Science, Bangalore, August 29, 2011
- “Nuclear Power: Risk and Ethics,” Lecture at Ashoka Trust in Ecology and Environment, Bangalore, August 29, 2011
- “United Kingdom,” Presentation at panel discussion on “The Challenges of Spent Fuel Management: Experience and Lessons from Around the World” at the AAAS Center for Science, Technology and Security Policy, Washington D.C., June 3, 2011

- “Nuclear Power: Global Trends, Future Projections,” Presentation at panel discussion on “The Jobs, Costs, and Security Landscape of a US Nuclear Expansion,” Organized by Center for Earth, Energy, and Democracy, Institute for Agriculture and Trade Policy, Minneapolis, March 25, 2011
- “Implications of Fukushima for Nuclear Safety: A Preliminary Assessment,” Presentation at panel discussion on “After the Earthquake: Japan’s Nuclear Plant Crisis” at the Woodrow Wilson School for Public and International Affairs, Princeton University, March 24, 2011
- “Nuclear Energy and Climate Change,” Plenary Lecture at the Conference on “Towards a Nuclear Weapon Free World” and the 10th Anniversary National Convention of the Coalition for Nuclear Disarmament and Peace, New Delhi, December 11, 2010
- “Nuclear Power: Current Trends, Future Projections, Developing Countries,” Bulletin of the Atomic Scientists, Doomsday Clock Symposium, Washington, D. C., November 4, 2010
- “Looking up at the Apocalypse: Disarmament, Climate Change, and Justice,” Panel Presentation at “For a Nuclear Free, Peaceful, Just, Sustainable World Conference”, Riverside Church, New York City, May 1, 2010
- “India: Climate Debates, Energy Trends,” Princeton Environmental Institute, Princeton University, February 5, 2010
- “Dealing with Climate Change: Equity, Justice, and Social Change,” Climate Change Panel, Bulletin of the Atomic Scientists, Doomsday Clock Symposium, New York City, January 13, 2010
- “A Nuclear Powered Solution to Climate Change: Feasible? Desirable?,” Environment Affairs Forum, Princeton University, November 24, 2009
- “India’s Energy Future: How Much Can Nuclear Power Contribute?,” Science, Technology, and Environmental Policy Seminar, Princeton University, September 28, 2009
- “Nuclear Energy in India: History and Future,” Rotary Club, Bangalore, March 14, 2009
- “Kya Dam Hai? The Economics of Nuclear Power,” Gujarat Vidyapeeth, December 8, 2008
- “Between Three Hard Places: India's Energy and Climate Change Policies,” Seminar, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, October 14, 2008
- “Nuclear Power as a Solution to Climate Change?,” Seminar, John F. Welch Technology Centre, General Electric Company, Bangalore, September 15, 2008
- “Economic Costs of Nuclear Power in India,” Seminar, Indian Institute of Management, Bangalore, March 21, 2008
- “Can Nuclear Power Help with Climate Change? Lessons from the Experience in India and Elsewhere,” Lecture for Postgraduate Certificate Course on Technology and Sustainable Development, Indian Institute of Technology, Madras, January 14, 2008
- “The Nuclear Deal and the Evolving Indo-US Relationship,” Lecture for course on “Globalization”, Swaraj Vidyapeeth, Bangalore, December 29, 2007
- “Indo-US Nuclear Deal,” Talk to CONCERNS, Student Group, Indian Institute of Science, Bangalore, November 17, 2007
- “The US-India Nuclear ‘Deal’: Underlying Issues and Debates,” Seminar, Institute for Social and Economic Change, Bangalore, November 15, 2007

- “Some Aspects of the US India Nuclear Deal,” Seminar, Indian Statistical Institute, Bangalore, November 7, 2007
- “Nuclear Energy: Economic and Environmental Aspects,” Lecture for course on “Approaching the Environment in India – New Theories and Methods in the Study of the Nature-Society Interface,” Institute for Social and Economic Change, Bangalore, August 9, 2007
- “Implications of the US India Nuclear Deal,” Presentation to the Citizens for Alternatives to Nuclear Energy, Bangalore, April 19, 2007
- “Breeder Reactors: Overview and Economics,” Seminar, National Institute for Advanced Studies, Bangalore, November 29, 2006
- “An Overview of Nuclear Power in India,” Presentation to the Greenpeace International Advisory Committee, Greenpeace, Bangalore, June 4, 2006
- “India: Prisoner of the Nuclear Dream,” Special Energy and Environmental Policy Lecture, Center for Energy and Environmental Policy, University of Delaware, May 18, 2006
- “The US-India Nuclear Deal,” Seminar, Science, Technology and Global Security Working Group, Program in Science, Technology and Society, Massachusetts Institute of Technology, May 12, 2006
- “Nuclear Power in India: Failed Past, Dubious Future,” Seminar, Nonproliferation Policy Education Center, Washington, D.C., May 10, 2006
- “The US-India Nuclear Deal,” Seminar, Center for International Security and Cooperation, Stanford University, May 1, 2006
- “The US-India Nuclear Deal,” Joint Seminar with Zia Mian, South Asia Studies Committee, Princeton University, April 25, 2006
- “Nuclear Weapons in India: Glimpses from History” and “Atomic Energy in India”, Two lectures at the National Law School of India University, Bangalore, April 1, 2006
- “South Asia: Under the Nuclear Shadow,” Seminar, Liu Institute for Global Studies, University of British Columbia, Vancouver, Canada, November 23, 2005
- “Promises and Failures: The Story of Atomic Energy in India,” Colloquium, Raman Research Institute, Bangalore, October 6, 2005
- “Nuclear Power: Plans, Prospects, and Constraints,” Presentation to Greenpeace, Bangalore, August 24, 2005
- “Nuclear Power in India: Current Status, Future Prospects,” Seminar, Centre for International Security and Cooperation, Stanford University, July 20, 2005
- “Ionizing Radiation and Health,” Lecture, Bangalore Planetarium, May 27, 2005
- “Technology Choices and their Implications: the Case of Nuclear Energy in India,” Lecture, Course on Technology and Policy in India, Indian Institute of Management, Bangalore, March 16, 2005
- “Economics of Nuclear Power in India,” Seminar, Institute for Social and Economic Change, Bangalore, February 17, 2005
- “Nuclear Energy and Nuclear Weapons: Issues for an Informed Public Debate,” Public Lecture, Organized by Society for Promoting Participative Ecosystem, Prayas, Centre for Environment Education, and others, Pune, January 12, 2005

- “Technology and Development: Nuclear Energy in India,” Two lectures, Course on Technology and Sustainable Development, Indian Institute of Technology, Chennai, January 4, 2005
- “Future of Nuclear Power in India,” Lunch Seminar, Program on Science and Global Security, Princeton University, October 1, 2004
- “Nuclear Power in India: An Overview,” Seminar, Department of Chemical Engineering, Indian Institute of Science, Bangalore, August 19, 2004
- “Secrecy and India’s Nuclear Establishment,” Lecture, Alternate Law Forum, Bangalore, May 21, 2004
- “A Progressive Bomb?,” Seminar, China Study Group, New York, January 31, 2004
- “An Estimate of India’s Uranium Enrichment Capacity,” Lunch Seminar, Program on Science and Global Security, Princeton University, August 6, 2003
- “Nuclear Power in India,” Seminar, Center for Energy and Environmental Policy, University of Delaware, May 15, 2003
- “Steps Towards Operationalizing the Indian Nuclear Arsenal,” Lunch Seminar, Program on Science and Global Security, Princeton University, January 22, 2003
- “Normal Accidents and Nuclear War,” Lecture, Course on “Engineers in Society,” New Jersey Institute of Technology, October 24, 2002
- “Deployment of Nuclear Weapons and Early Warning in South Asia,” Technical Seminar, Security Studies Program, Massachusetts Institute of Technology, October 10, 2002
- “Beyond Missile Defense,” Division of Natural Sciences and Mathematics Colloquium, Colgate University, April 19, 2002
- “Health Impacts from Uranium Mining in India,” Presentation to ASHA, Princeton University, February 16, 2002
- “The Environmental and Health Impacts of the Nuclear Fuel Cycle,” Seminar, Institute for Social and Economic Change, Bangalore, January 3, 2002
- “Uranium Mining and Health in India,” Presentation to ASHA, Columbia University, November 4, 2001
- “Economics of Nuclear Power from Fast Breeder Reactors in India,” Seminar, Indira Gandhi Institute for Development Research, August 20, 2001
- “Nuclear Power Economics in India: Fast Breeders vs. Heavy Water Reactors,” Seminar, Center for Energy and Environmental Studies, Princeton University, July 10, 2001
- “Scientists and India’s Nuclear Bomb,” Seminar, Center for International Security and Cooperation, Stanford University, March 13, 2001
- “Scientists and India’s Nuclear Bomb,” Lecture, Yale Center for International and Area Studies, Yale University, October 26, 2000
- “Nuclear Weapons in South Asia: A Scientist’s Perspective,” Presentation to the Stanford India Association, Stanford University, June 29, 2000
- “Prisoners of the Nuclear Dream: India, Pakistan, and the Making of Nuclear Nations,” Seminar, Program on Science, Technology and Society, Massachusetts Institute of Technology, February 19, 1999

- “Nuclear Energy and Weapons in South Asia,” Seminar, Gettysburg College, January 29, 1998
- “The Effects of Nuclear Explosions - a Case Study of Mumbai,” Seminar, School of International Studies, Jawaharlal Nehru University, New Delhi, February 24, 1997
- “Walking Technicolor Signatures at Hadron Colliders,” Seminar, Center for Theoretical Studies, Indian Institute of Science, Bangalore, July 1992
- “Electroweak Symmetry Breaking, Walking Technicolor, and the SSC,” Seminar, Department of Physics, University of Wuppertal, Germany, February 1992