

Testimony of Gordon R. Thompson

to

The Public Utilities Commission of the State of California

December 2004

Appendix A: Tables

Table 1
Selected Characteristics of SONGS Unit 2 and Unit 3

| Characteristic | San Onofre Unit 2 | San Onofre Unit 3 |
|---|--------------------------|--------------------------|
| Rated power | 3,438 MWt; 1,070 MWe | 3,438 MWt; 1,080 MWe |
| Average capacity factor, 1998-2003 | 94 percent | 90 percent |
| Reactor vendor | Combustion Engineering | Combustion Engineering |
| Number of fuel assemblies in reactor core | 217 | 217 |
| Mass of uranium in a fresh fuel assembly | 485 kg | 485 kg |
| Year of first commercial operation | 1983 | 1984 |
| Year when operating license expires | 2022 | 2022 |
| Capacity of spent-fuel pool | 1,542 assemblies | 1,542 assemblies |
| Inventory of spent fuel in pool in November 1998 | 870 assemblies | 918 assemblies |
| Date when SCE predicts pool will lose space needed to receive full core offload | July 2007 | March 2008 |

Notes:

(a) Data are from: NRC, 2004b; Larson, 1985; NRC, 1979; CCC, 2001; SCE, 2002a; <http://www.nrc.gov/OPA/drycask/sfdata.htm>, accessed 30 May 2001.

Table 2
Amounts of Cesium-137 in Nuclear Fuel Associated With SONGS Unit 2 or Unit 3

| Category of Nuclear Fuel | Amount of Cs-137 (MCi) |
|---|------------------------|
| One spent fuel assembly at discharge from reactor (15.8 MWt per assembly, 90% capacity factor, discharge after 54 months, 485 kgU/assembly) | 0.071 |
| One reactor core at operating equilibrium (217 assemblies, av. burnup = 50% of discharge burnup) | 7.7 |
| One spent-fuel pool at full loading (1,325 assemblies, av. age after discharge = 14 yr) | 68 |
| One ISFSI module at full capacity (24 assemblies, av. age after discharge = 14 yr) | 1.2 |

Notes:

(a) From data for Ginna spent fuel batch 16 (Sailor et al, 1987, Tables A.11 and A.13), one finds that the inventory of Cs-137 in newly-discharged spent fuel is 3.05 kCi per GWt-day of fission energy yield. For the assumed conditions of a SONGS fuel assembly at discharge, this inventory is 0.071 MCi. The same result can be obtained by assuming an energy yield of 200 MeV per fission and a Cs-137 fission fraction of 6.0 percent.

Table 3
Potential Modes and Instruments of Attack on a Nuclear Power Plant

| Mode of Attack | Characteristics | Present Defense |
|----------------------------------|--|--|
| Commando-style attack | <ul style="list-style-type: none">• Could involve heavy weapons and sophisticated tactics• Successful attack would require substantial planning and resources | Alarms, fences and lightly-armed guards, with offsite backup |
| Land-vehicle bomb | <ul style="list-style-type: none">• Readily obtainable• Highly destructive if detonated at target | Vehicle barriers at entry points to Protected Area |
| Anti-tank missile | <ul style="list-style-type: none">• Readily obtainable• Highly destructive at point of impact | None if missile launched from offsite |
| Commercial aircraft | <ul style="list-style-type: none">• More difficult to obtain than pre-9/11• Can destroy larger, softer targets | None |
| Explosive-laden smaller aircraft | <ul style="list-style-type: none">• Readily obtainable• Can destroy smaller, harder targets | None |
| 10-kilotonne nuclear weapon | <ul style="list-style-type: none">• Difficult to obtain• Assured destruction if detonated at target | None |

Notes:

(a) This table is adapted from Table 1 of: Thompson, 2003.

Table 4
Two Options for Management of Spent Fuel at SONGS Unit 2 or Unit 3,
Commencing in Year X and Assuming Continued Operation of the Reactor

| Category of Spent Fuel | Number of Fuel Assemblies | |
|---|--|---|
| | Base-Case Option | Option Involving Reduction in Capacity of the Spent-Fuel Pool |
| Number of fuel assemblies in reactor core | 217 | 217 |
| Annual discharge of spent fuel from reactor | 48 (1/3 of core each 18 months) | 48 (1/3 of core each 18 months) |
| Initial capacity of spent-fuel pool (year X) | 1,542 | 1,542 |
| Reduced capacity of pool (year X+2 and thereafter) | Not applicable (capacity remains at 1,542) | 506 (4/3 core plus full offload of 1 core) |
| Initial inventory of spent fuel in pool (year X) | 1,325 (1,542 minus full offload of 1 core) | 1,325 (1,542 minus full offload of 1 core) |
| Inventory of spent fuel in pool in year X+2 and thereafter | 1,325 | 240 (5 years of reactor discharge @ 48/year) |
| Spent fuel transferred to ISFSI between year X and year X+2 | $48 \times 2 = 96$ | $(48 \times 2) + (1,325 - 240) = 1,181$ |
| Annual transfer of spent fuel to ISFSI after year X+2 | 48 | 48 |
| Spent fuel transferred to ISFSI after reactor is shut down | 1,325 | 240 |

Table 5
Estimated Capital Expenses of Two Options for Management of Spent Fuel at SONGS Unit 2 and Unit 3, Commencing in Year X and Assuming Continued Operation of the Reactors

| Indicator | Magnitude of Indicator | |
|---|--|---|
| | Base-Case Option | Enhanced-Defense Option |
| Capital expense to transfer spent fuel to ISFSI | \$120 per kgU = \$58,000 per assembly | \$240 per kgU = \$116,000 per assembly |
| Annual discharge of spent fuel from reactors | 48 x 2 = 96 assemblies | 48 x 2 = 96 assemblies |
| Initial inventory of spent fuel in pools (year X) | 1,325 x 2 = 2,650 assemblies | 1,325 x 2 = 2,650 assemblies |
| Capital expense to re-equip pools with low-density racks | Not applicable | \$10 million |
| Inventory of spent fuel in pools in year X+2 and thereafter | 1,325 x 2 = 2,650 assemblies | 240 x 2 = 480 assemblies |
| Spent fuel transferred to ISFSI between year X and year X+2 | 96 x 2 = 192 assemblies | 1,181 x 2 = 2,362 assemblies |
| Capital expense to transfer spent fuel to ISFSI between year X and year X+2 | \$11 million | \$274 million |
| Annual transfer of spent fuel to ISFSI after year X+2 | 48 x 2 = 96 assemblies | 48 x 2 = 96 assemblies |
| Annual capital expense to transfer spent fuel to ISFSI after year X+2 | \$5.6 million | \$11 million |
| Spent fuel transferred to ISFSI after reactor is shut down | 2,650 assemblies | 480 assemblies |
| Capital expense to transfer spent fuel to ISFSI after reactor is shut down | \$154 million | \$56 million |
| Increment of total capital expense above Base Case | Zero | \$175 million plus \$5.5 million per year of reactor operation after year X+2 |

Table 6
Estimated Additional Costs (i.e., Costs Above the Base Case) of Potential Measures to Provide Enhanced Defense of SONGS Unit 2 and Unit 3 and their Spent Fuel: Assuming Initiation of the Enhanced-Defense Program in Year X and Continued Operation of the Reactors

| Defensive Measure | Additional Capital Expense (\$ million) | Additional Annual O&M Expense (\$ million) |
|--|---|--|
| Sentinel (2 units) | 15 (over 2 yrs) | 8.5 |
| Phalanx (2 units) | 20 (over 2 yrs) | 11 |
| Expanded DBT and stronger defense of the onsite ISFSI | 3/yr | 15 |
| Automated shutdown system | 75 (over 2 yrs) | -- |
| Emergency cooling system | 75 (over 2 yrs) | -- |
| Re-equipment of spent-fuel pools with low-density racks and transfer of excess fuel to a hardened, dispersed, onsite ISFSI | 175 plus 5.5/yr after year X+2 | -- |
| Enhanced capability for onsite damage control | 2/yr | 10 |
| Enhanced capability for offsite emergency response | 2/yr | 10 |
| Total | 374 plus 12.5/yr after year X+2 | 54.5 |

Table 7
Estimated Additional Costs (i.e., Costs Above the Base Case) of Potential Measures to Provide Enhanced Defense of SONGS Unit 2 and Unit 3 and their Spent Fuel: Assuming Initiation of the Enhanced-Defense Program in Year X and Shutdown of the Reactors in Year X

| Defensive Measure | Additional Capital Expense (\$ million) | Additional Annual O&M Expense (\$ million) |
|---|---|--|
| Sentinel (2 units) | -- | -- |
| Phalanx (2 units) | -- | -- |
| Expanded DBT and stronger defense of the onsite ISFSI | 2/yr | 10 |
| Automated shutdown system | -- | -- |
| Emergency cooling system | -- | -- |
| Re-equipment of spent-fuel pools with low-density racks (<u>not done in this scenario; existing racks would be retained and emptied</u>) and transfer of excess fuel to a hardened, dispersed, onsite ISFSI | 154 (over 5 yrs) | -- |
| Enhanced capability for onsite damage control | 0.7/yr | 3 |
| Enhanced capability for offsite emergency response | 0.7/yr | 3 |
| Total | 154 plus 3.4/yr | 16 |

Table 8

Estimated Additional Costs (i.e., Costs Above the Base Case) of Potential Measures to Provide Enhanced Defense of SONGS Unit 2 and Unit 3 and their Spent Fuel: Assuming Initiation of the Enhanced-Defense Program in Year X and Shutdown of the Reactors in Year X+3

| Defensive Measure | Additional Capital Expense (\$ million) | Additional Annual O&M Expense (\$ million) |
|--|--|--|
| Sentinel (2 units) | -- | -- |
| Phalanx (2 units) | -- | -- |
| Expanded DBT and stronger defense of the onsite ISFSI | 3/yr through year X+3; 2/yr thereafter | 15 through year X+3; 10 thereafter |
| Automated shutdown system | -- | -- |
| Emergency cooling system | -- | -- |
| Re-equipment of spent-fuel pools with low-density racks and transfer of excess fuel to a hardened, dispersed, onsite ISFSI | 180.5 | -- |
| Enhanced capability for onsite damage control | 2/yr through year X+3; 0.7/yr thereafter | 10 through year X+3; 3 thereafter |
| Enhanced capability for offsite emergency response | 2/yr through year X+3; 0.7/yr thereafter | 10 through year X+3; 3 thereafter |
| Total | 201.5 plus 3.4/yr after year X+3 | 35 through year X+3; 16 thereafter |

Notes:

(a) Sentinel, Phalanx, the automated shutdown system, and the emergency cooling system are not deployed.

(b) The spent-fuel pools are reduced to low density over two years, operated at low density for the third year, then emptied over five years.

Table 9
Estimated Cumulative Additional Costs (i.e., Costs Above the Base Case) of
Potential Measures to Provide Enhanced Defense of SONGS Unit 2 and Unit 3 and
their Spent Fuel: Four Scenarios Over a 15-Year Period

| Scenario | Cumulative Additional Cost (\$ million) | | |
|--|--|--|-------|
| | Capital Expense | O & M Expense | Total |
| I (Base Case): Continued operation of reactors from year X through year X + 15; no enhanced-defense program | -- | -- | -- |
| II (Table 6): Continued operation of reactors from year X through year X + 15; initiation in year X of an enhanced-defense program that continues through year X+15 | $374 + (12.5 \times 13)$ = 536.5 | (54.5×15) = 817.5 | 1,354 |
| III (Table 7): Shutdown of reactors in year X; initiation in year X of an enhanced-defense program that continues through year X + 15 | $154 + (3.4 \times 15)$ = 205 | (16×15) = 240 | 445 |
| IV (Table 8): Continued operation of reactors from year X until they are shut down in year X + 3; initiation in year X of an enhanced-defense program that continues through year X + 15 | $201.5 + (3.4 \times 12)$ = 242.3 | (35×3) + (16×12) = 297 | 539 |

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Appendix C: Curriculum Vitae

Curriculum Vitae for Gordon R. Thompson
September 2003

Professional expertise

- Technical and policy analyst in the fields of energy, environment, sustainable development, and international security.

Current appointments

- Executive director, Institute for Resource & Security Studies (IRSS), Cambridge, Massachusetts.
- Research Professor, George Perkins Marsh Institute, Clark University, Worcester, Massachusetts.

Education

- D.Phil., applied mathematics, Oxford University (Balliol College), 1973.
- B.E., mechanical engineering, University of New South Wales, Sydney, Australia, 1967.
- B.Sc., mathematics & physics, University of New South Wales, 1966.

Project sponsors and tasks (selected)

- STAR Foundation, New York, 2002-2003: reviewed planning and actions for decommissioning of research reactors at Brookhaven National Laboratory.
- Attorney General of Utah, 2003: conducted technical analysis and prepared expert testimony regarding a proposed national storage facility for spent nuclear fuel.
- Mothers for Peace, California, 2002-2003: analyzed risk issues and prepared expert testimony associated with the Diablo Canyon nuclear power plant.
- Citizens Awareness Network, Massachusetts, 2002-2003: conducted analysis on robust storage of spent nuclear fuel.
- Tides Center, California, 2002-2003: conducted analysis for the Santa Susana Field Laboratory (SSFL) Advisory Panel regarding the history of releases of radioactive material from the SSFL.
- Orange County, North Carolina, 1999-2002: assessed risk issues associated with the Harris nuclear power plant, identified risk-reduction options, and prepared expert testimony.
- William and Flora Hewlett Foundation and other sponsors, 1999-2003: performed research and project development for conflict-management projects, through IRSS's International Conflict Management Program.

- STAR Foundation, New York, 2000-2001: assessed risk issues associated with the Millstone nuclear power plant, identified risk-reduction options, and prepared expert testimony.
- Massachusetts Water Resources Authority, 2000: evaluated risks associated with water supply and wastewater systems that serve greater Boston.
- Canadian Senate, Energy & Environment Committee, 2000: reviewed risk issues associated with the Pickering Nuclear Generating Station.
- Greenpeace International, Amsterdam, 2000: reviewed impacts associated with the La Hague nuclear complex in France.
- Government of Ireland, 1998-2001: developed framework for assessment of impacts and alternative options associated with the Sellafield nuclear complex in the UK.
- Clark University, Worcester, Massachusetts, 1998-1999: participated in confidential review of outcomes of a major foundation's grants related to climate change.
- UN High Commissioner for Refugees, 1998: developed a strategy for conflict management in the CIS region.
- General Council of County Councils (Ireland), W. Alton Jones Foundation (USA), and Nuclear Free Local Authorities (UK), 1996-2000: assessed safety and economic issues of nuclear fuel reprocessing in the UK; assessed alternative options.
- Environmental School, Clark University, Worcester, Massachusetts, 1996: session leader at the Summer Institute, "Local Perspectives on a Global Environment".
- Greenpeace Germany, Hamburg, 1995-1996: a study on war, terrorism and nuclear power plants.
- HKH Foundation, New York, and Winston Foundation for World Peace, Washington, DC, 1994-1996: studies and workshops on preventive action and its role in US national security planning.
- Carnegie Corporation of New York, Winston Foundation for World Peace, Washington, DC, and others, 1995: collaboration with the Organization for Security and Cooperation in Europe to facilitate improved coordination of activities and exchange of knowledge in the field of conflict management.
- World Bank, 1993-1994: a study on management of data describing the performance of projects funded by the Global Environment Facility (joint project of IRSS and Clark University).
- International Physicians for the Prevention of Nuclear War, 1993-1994: a study on the international control of weapons-usable fissile material.
- Government of Lower Saxony, Hannover, Germany, 1993: analysis of standards for radioactive waste disposal.
- University of Vienna (using funds supplied by the Austrian government), 1992: review of radioactive waste management at the Dukovany nuclear power plant, Czech Republic.
- Sandia National Laboratories, 1992-1993: advice to the US Department of Energy's Office of Foreign Intelligence.
- US Department of Energy and Battelle Pacific Northwest Laboratories, 1991-1992: advice for the Intergovernmental Panel on Climate Change regarding the design of an information system on technologies that can limit greenhouse gas emissions (joint project of IRSS, Clark University and the Center for Strategic and International Studies).

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- MacArthur Foundation, Chicago, Illinois, W. Alton Jones Foundation, Charlottesville, Virginia, and other funding sources, 1984-1993: policy analysis and public education on a "global approach" to arms control and disarmament.
- Energy Research Foundation, Columbia, South Carolina, and Peace Development Fund, Amherst, Massachusetts, 1988-1992: review of the US government's tritium production (for nuclear weapons) and its implications.
- Coalition of Environmental Groups, Toronto, Ontario (using funds supplied by Ontario Hydro under the direction of the Ontario government), 1990-1993: coordination and conduct of analysis and preparation of testimony on accident risk of nuclear power plants.
- Greenpeace International, Amsterdam, Netherlands, 1988-1990: review of probabilistic risk assessment for nuclear power plants.
- Bellerive Foundation, Geneva, Switzerland, 1989-1990: planning for a June 1990 colloquium on disarmament and editing of proceedings.
- Iler Research Institute, Harrow, Ontario, 1989-1990: analysis of regulatory response to boiling-water reactor accident potential.
- Winston Foundation for World Peace, Boston, Massachusetts, and other funding sources, 1988-1989: analysis of future options for NATO (joint project of IRSS and the Institute for Peace and International Security).
- Nevada Nuclear Waste Project Office, Carson City, Nevada (via Clark University), 1989-1990: analyses of risk aspects of radioactive waste management and disposal.
- Ontario Nuclear Safety Review (conducted by the Ontario government), Toronto, Ontario, 1987: review of safety aspects of CANDU reactors.
- Washington Department of Ecology, Olympia, Washington, 1987: analyses of risk aspects of a proposed radioactive waste repository at Hanford.
- Natural Resources Defense Council, Washington, DC, 1986-1987: preparation of expert testimony on hazards of the Savannah River Plant, South Carolina.
- Lakes Environmental Association, Bridgton, Maine, 1986: analysis of federal regulations for disposal of radioactive waste.
- Greenpeace Germany, Hamburg, 1986: participation in an international study on the hazards of nuclear power plants.
- Three Mile Island Public Health Fund, Philadelphia, Pennsylvania, 1983-1989: studies related to the Three Mile Island nuclear power plant.
- Attorney General, Commonwealth of Massachusetts, 1984-1989: analyses of the safety of the Seabrook nuclear power plant; preparation of expert testimony.
- Union of Concerned Scientists, Cambridge, Massachusetts, 1980-1985: studies on energy demand and supply, nuclear arms control, and the safety of nuclear installations.
- Conservation Law Foundation of New England, Boston, Massachusetts, 1985: preparation of expert testimony on cogeneration potential at a Maine papermill.
- Town & Country Planning Association, London, UK, 1982-1984: coordination and conduct of a study on safety and radioactive waste implications of the proposed Sizewell nuclear power plant; testimony to the Sizewell Public Inquiry.

- US Environmental Protection Agency, Washington, DC, 1980-1981: assessment of the cleanup of Three Mile Island Unit 2 nuclear power plant.
- Center for Energy & Environmental Studies, Princeton University, Princeton, New Jersey, and Solar Energy Research Institute, Golden, Colorado, 1979-1980: studies on the potentials of renewable energy sources.
- Government of Lower Saxony, Hannover, Federal Republic of Germany, 1978-1979: coordination and conduct of studies on safety aspects of the proposed Gorleben nuclear fuel cycle center.

Other experience (selected)

- Principal investigator, project on "Exploring the Role of 'Sustainable Cities' in Preventing Climate Disruption", involving IRSS and three other organizations, 1990-1991.
- Visiting fellow, Peace Research Centre, Australian National University, 1989.
- Principal investigator, Three Mile Island emergency planning study, involving IRSS, Clark University and other partners, 1987-1989.
- Co-leadership (with Paul Walker) of a study group on nuclear weapons proliferation, Institute of Politics, Harvard University, 1981.
- Foundation (with others) of an ecological political movement in Oxford, UK, which contested the 1979 Parliamentary election.
- Conduct of cross-examination and presentation of expert testimony, on behalf of the Political Ecology Research Group, at the 1977 Public Inquiry into proposed expansion of reprocessing capacity at Windscale, UK.
- Conduct of research on plasma theory (while a D.Phil candidate), as an associate staff member, Culham Laboratory, UK Atomic Energy Authority, 1969-1973.
- Service as a design engineer on coal-fired power plants, New South Wales Electricity Commission, Sydney, Australia, 1968.

Publications (selected)

- "Reducing the Hazards from Stored Spent Power-Reactor Fuel in the United States" (with Robert Alvarez, Jan Beyea, Klaus Janberg, Jungmin Kang, Ed Lyman, Allison Macfarlane and Frank N. von Hippel), *Science and Global Security*, Volume 11, 2003, pp 1-51.
- "Health, Human Security and Social Reconstruction in Afghanistan" (with Paula Gutlové and Jacob Hale Russell), in John D. Montgomery and Dennis A. Rondinelli (eds), *Beyond Reconstruction in Afghanistan*, Palgrave Macmillan, in press.
- *Psychosocial Healing: A Guide for Practitioners, based on programs of the Medical Network for Social Reconstruction in the Former Yugoslavia* (with Paula Gutlové), IRSS, Cambridge, Massachusetts and OMEGA Health Care Center, Graz, Austria, May 2003.
- *A Call for Action to Protect the Nation Against Enemy Attack on Nuclear Power Plants and Spent Fuel*, and a Supporting Document, Mothers for Peace, San Luis Obispo, California, April 2003 and May 2003.

- "Human Security: Expanding the Scope of Public Health" (with Paula Gutlove), *Medicine, Conflict and Survival*, Volume 19, 2003, pp 17-34.
- *Social Reconstruction in Afghanistan through the Lens of Health and Human Security* (with Paula Gutlove and Jacob Hale Russell), IRSS, Cambridge, Massachusetts, May 2003.
- *Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security*, a report commissioned by Citizens Awareness Network, Shelburne Falls, Massachusetts, January 2003.
- *Medical Network for Social Reconstruction in the Former Yugoslavia: A Survey of Participants' Views on the Network's Goals and Achievements*, IRSS, Cambridge, Massachusetts, September 2001.
- *The Potential for a Large, Atmospheric Release of Radioactive Material from Spent Fuel Pools at the Harris Nuclear Power Plant: The Case of a Pool Release Initiated by a Severe Reactor Accident*, a report for Orange County, North Carolina, 20 November 2000.
- *A Review of the Accident Risk Posed by the Pickering 'A' Nuclear Generating Station*, a report for the Standing Committee on Energy, Environment and Natural Resources, Canadian Senate, August 2000.
- *High-Level Radioactive Liquid Waste at Sellafield: An Updated Review*, a report for the UK Nuclear Free Local Authorities, June 2000.
- *Hazard Potential of the La Hague Site: An Initial Review*, a report for Greenpeace International, May 2000.
- *A Strategy for Conflict Management: Integrated Action in Theory and Practice* (with Paula Gutlove), IRSS, Cambridge, Massachusetts, March 1999.
- *Risks and Alternative Options Associated with Spent Fuel Storage at the Shearon Harris Nuclear Power Plant*, a report for Orange County, North Carolina, February 1999.
- *High Level Radioactive Liquid Waste at Sellafield: Risks, Alternative Options and Lessons for Policy*, IRSS, Cambridge, Massachusetts, June 1998.
- "Science, democracy and safety: why public accountability matters", in F. Barker (ed), *Management of Radioactive Wastes: Issues for local authorities*, Thomas Telford, London, 1998.
- "Conflict Management and the OSCE" (with Paula Gutlove), *OSCE/ODIHR Bulletin*, Volume 5, Number 3, Fall 1997.
- *Safety of the Storage of Liquid High-Level Waste at Sellafield* (with Peter Taylor), Nuclear Free Local Authorities, UK, November 1996.
- *Assembling Evidence on the Effectiveness of Preventive Actions, their Benefits, and their Costs: A Guide for Preparation of Evidence*, IRSS, Cambridge, Massachusetts, August 1996.
- *War, Terrorism and Nuclear Power Plants*, Peace Research Centre, Australian National University, Canberra, October 1996.
- "The Potential for Cooperation by the OSCE and Non-Governmental Actors on Conflict Management" (with Paula Gutlove), *Helsinki Monitor*, Volume 6 (1995), Number 3.
- "Potential Characteristics of Severe Reactor Accidents at Nuclear Plants", "Monitoring and Modelling Atmospheric Dispersion of Radioactivity Following a Reactor Accident"

- (with Richard Sclove, Ulrike Fink and Peter Taylor), "Safety Status of Nuclear Reactors and Classification of Emergency Action Levels", and "The Use of Probabilistic Risk Assessment in Emergency Response Planning for Nuclear Power Plant Accidents" (with Robert Goble), in D. Golding, J. X. Kasperson and R. E. Kasperson (eds), *Preparing for Nuclear Power Plant Accidents*, Westview Press, Boulder, Colorado, 1995.
- *A Data Manager for the Global Environment Facility* (with Robert Goble), Environment Department, The World Bank, June 1994.
 - *Preventive Diplomacy and National Security* (with Paula Gutlove), Winston Foundation for World Peace, Washington, DC, May 1994.
 - *Opportunities for International Control of Weapons-Usable Fissile Material*, International Physicians for the Prevention of Nuclear War, Cambridge, Massachusetts, January 1994.
 - "Article III and IAEA Safeguards", in F. Barnaby and P. Ingram (eds), *Strengthening the Non-Proliferation Regime*, Oxford Research Group, Oxford, UK, December 1993.
 - *Risk Implications of Potential New Nuclear Plants in Ontario* (prepared with the help of eight consultants), a report for the Coalition of Environmental Groups, Toronto, submitted to the Ontario Environmental Assessment Board, November 1992 (3 volumes).
 - *Strengthening the International Atomic Energy Agency*, IRSS, Cambridge, Massachusetts, September 1992.
 - *Design of an Information System on Technologies that can Limit Greenhouse Gas Emissions* (with Robert Goble and F. Scott Bush), Center for Strategic and International Studies, Washington, DC, May 1992.
 - *Managing Nuclear Accidents: A Model Emergency Response Plan for Power Plants and Communities* (with six other authors), Westview Press, Boulder, CO, 1992.
 - "Let's X-out the K" (with Steven C. Sholly), *Bulletin of the Atomic Scientists*, March 1992, pp 14-15.
 - "A Worldwide Programme for Controlling Fissile Material", and "A Global Strategy for Nuclear Arms Control", in F. Barnaby (ed), *Plutonium and Security*, Macmillan Press, UK, 1992.
 - *No Restart for K Reactor* (with Steven C. Sholly), IRSS, Cambridge, Massachusetts, October 1991.
 - *Regulatory Response to the Potential for Reactor Accidents: The Example of Boiling-Water Reactors*, IRSS, Cambridge, Massachusetts, February 1991.
 - *Peace by Piece: New Options for International Arms Control and Disarmament*, IRSS, Cambridge, Massachusetts, January 1991.
 - *Developing Practical Measures to Prevent Climate Disruption* (with Robert Goble), CENED Research Report No. 6, Clark University, Worcester, Massachusetts, August 1990.
 - "Treaty a Useful Relic", *Bulletin of the Atomic Scientists*, July/August 1990, pp 32-33.
 - "Practical Steps for the 1990s", in Sadruddin Aga Khan (ed), *Non-Proliferation in a Disarming World*, Proceedings of the Groupe de Bellerive's 6th International Colloquium, Bellerive Foundation, Geneva, Switzerland, 1990.
 - *A Global Approach to Controlling Nuclear Weapons*, IRSS, Cambridge, Massachusetts, October 1989.

- *IAEA Safety Targets and Probabilistic Risk Assessment* (with three other authors), Greenpeace International, Amsterdam, August 1989.
- *New Directions for NATO* (with Paul Walker and Pam Solo), published jointly by IRSS and the Institute for Peace and International Security (both of Cambridge, Massachusetts), December 1988.
- "Verifying a Halt to the Nuclear Arms Race", in F. Barnaby (ed), *A Handbook of Verification Procedures*, Macmillan Press, UK, 1990.
- "Verification of a Cutoff in the Production of Fissile Material", in F. Barnaby (ed), *A Handbook of Verification Procedures*, Macmillan Press, UK, 1990.
- "Severe Accident Potential of CANDU Reactors," Consultant's Report in *The Safety of Ontario's Nuclear Power Reactors*, Ontario Nuclear Safety Review, Toronto, February 1988.
- *Nuclear-Free Zones* (edited with David Pitt), Croom Helm Ltd, Beckenham, UK, 1987.
- *Risk Assessment Review For the Socioeconomic Impact Assessment of the Proposed High-Level Nuclear Waste Repository at Hanford Site, Washington* (edited; written with five other authors), prepared for the Washington Department of Ecology, December 1987.
- *The Nuclear Freeze Revisited* (with Andrew Haines), Nuclear Freeze and Arms Control Research Project, Bristol, UK, November 1986. Variants of the same paper have appeared as Working Paper No. 18, Peace Research Centre, Australian National University, Canberra, February 1987, and in *ADIU Report*, University of Sussex, Brighton, UK, Jan/Feb 1987, pp 6-9.
- *International Nuclear Reactor Hazard Study* (with fifteen other authors), Greenpeace, Hamburg, Federal Republic of Germany (2 volumes), September 1986.
- "What happened at Reactor Four" (the Chernobyl reactor accident), *Bulletin of the Atomic Scientists*, August/September 1986, pp 26-31.
- *The Source Term Debate: A Report by the Union of Concerned Scientists* (with Steven C. Sholly), Union of Concerned Scientists, Cambridge, Massachusetts, January 1986.
- "Checks on the spread" (a review of three books on nuclear proliferation), *Nature*, 14 November 1985, pp 127-128.
- Editing of *Perspectives on Proliferation*, August 1985, published by the Proliferation Reform Project, IRSS.
- "A Turning Point for the NPT?", *ADIU Report*, University of Sussex, Brighton, UK, Nov/Dec 1984, pp 1-4.
- "Energy Economics", in J. Dennis (ed), *The Nuclear Almanac*, Addison-Wesley, Reading, Massachusetts, 1984.
- "The Genesis of Nuclear Power", in J. Tirman (ed), *The Militarization of High Technology*, Ballinger, Cambridge, Massachusetts, 1984.
- *A Second Chance: New Hampshire's Electricity Future as a Model for the Nation* (with Linzee Weld), Union of Concerned Scientists, Cambridge, Massachusetts, 1983.
- *Safety and Waste Management Implications of the Sizewell PWR* (prepared with the help of six consultants), a report to the Town & Country Planning Association, London, UK, 1983.

Testimony of Gordon R. Thompson to CPUC, December 2004
Appendix C: Curriculum Vitae
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- *Utility-Scale Electrical Storage in the USA: The Prospects of Pumped Hydro, Compressed Air, and Batteries*, Princeton University report PU/CEES #120, 1981.
- *The Prospects for Wind and Wave Power in North America*, Princeton University report PU/CEES # 117, 1981.
- *Hydroelectric Power in the USA: Evolving to Meet New Needs*, Princeton University report PU/CEES # 115, 1981.
- Editing and part authorship of "Potential Accidents & Their Effects", Chapter III of *Report of the Gorleben International Review*, published in German by the Government of Lower Saxony, FRG, 1979; Chapter III published in English by the Political Ecology Research Group, Oxford, UK.
- *A Study of the Consequences to the Public of a Severe Accident at a Commercial FBR located at Kalkar, West Germany*, Political Ecology Research Group, 1978.

Expert presentations and testimony (selected)

- European Parliament, 2003: invited presentation to EP members regarding safety and security issues at the Sellafield nuclear site in the UK, and broader implications.
- US Congress, 2002 and 2003: invited presentations at member-sponsored staff briefings on vulnerabilities of nuclear-power facilities to attack and options for improved defenses.
- Numerous public forums in the USA, 2001-2003: invited presentations to public officials and general audiences regarding vulnerabilities of nuclear-power facilities to attack and options for improved defenses.
- UK Consensus Conference on Radioactive Waste Management, 1999: invited testimony on information and decision-making.
- Joint Committee on Public Enterprise and Transport, Irish Parliament, 1999: invited testimony on nuclear fuel reprocessing and international security.
- UK and Irish Parliaments, 1998: invited presentations to members on risks and alternative options associated with nuclear fuel reprocessing in the UK.
- Center for Russian Environmental Policy, Moscow, 1996: invited presentation at a forum in parallel with the G-7 Nuclear Safety Summit.
- Lacey Township Zoning Board, New Jersey, 1995: testimony regarding radioactive waste management.
- Ontario Court of Justice, Toronto, Ontario, 1993: testimony regarding Canada's Nuclear Liability Act.
- Oxford Research Group, seminar on "The Plutonium Legacy", Rhodes House, Oxford, UK, 1993: invited presentation on nuclear safeguards.
- Defense Nuclear Facilities Safety Board, Washington, DC, 1991: testimony regarding the proposed restart of K-reactor, Savannah River Site.
- Conference to consider amending the Partial Test Ban Treaty, United Nations, New York, 1991: presentation on a global approach to arms control and disarmament.
- US Department of Energy, hearing on draft EIS for new production reactor capacity, Columbia, South Carolina, 1991: testimony on tritium need and implications of tritium production options.

- Society for Risk Analysis, 1990 annual meeting, New Orleans, special session on nuclear emergency planning: presentation on real-time techniques for anticipating emergencies.
- Parliamentarians' Global Action, 11th Annual Parliamentary Forum, United Nations, Geneva, 1990: invited presentation on the potential for multilateral nuclear arms control.
- Advisory Committee on Nuclear Facility Safety, Washington, DC, 1989: testimony on public access to information and on government accountability.
- Peace Research Centre, Australian National University, seminar on "Australia and the Fourth NPT Review Conference", Canberra, 1989: invited presentation regarding a universal nuclear weapons non-proliferation regime.
- Carnegie Endowment for International Peace, Conference on "Nuclear Non-Proliferation and the Role of Private Organizations", Washington, DC, 1989: invited presentation on options for reform of the non-proliferation regime.
- US Department of Energy, EIS scoping hearing, Columbia, South Carolina, 1988: testimony on appropriate scope of an EIS for new production reactor capacity.
- International Physicians for the Prevention of Nuclear War, 6th and 7th Annual Congresses, Koln, FRG, 1986 and Moscow, USSR, 1987: invited presentations on relationships between nuclear power and the threat of nuclear war.
- County Council, Richland County, South Carolina, 1987: testimony on implications of severe reactor accidents at the Savannah River Plant.
- Maine Land Use Regulation Commission, 1985: testimony on cogeneration potential at facilities of Great Northern Paper Company.
- Interfaith Hearings on Nuclear Issues, Toronto, Ontario, 1984: invited presentations on options for Canada's nuclear trade and Canada's involvement in nuclear arms control.
- Sizewell Public Inquiry, UK, 1984: testimony on safety and radioactive waste implications of the proposed Sizewell nuclear power plant.
- New Hampshire Public Utilities Commission, 1983: testimony on electricity demand and supply options for New Hampshire.
- Atomic Safety & Licensing Board, US Nuclear Regulatory Commission, 1983: testimony on use of filtered venting at the Indian Point nuclear power plant.
- US National Advisory Committee on Oceans and Atmosphere, 1982: testimony on implications of ocean disposal of radioactive waste.
- Environmental & Energy Study Conference, US Congress, 1982: invited presentation on implications of radioactive waste management.

Miscellaneous

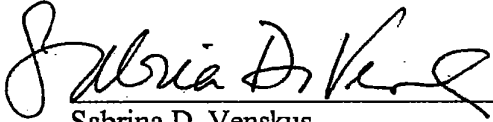
- Married, two children.
- Extensive experience in public speaking and interviews by mass media.
- Author of numerous essays and letters in newspapers and magazines.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of TESTIMONY OF GORDON THOMPSON ON BEHALF OF CALIFORNIA EARTH CORPS in A.04-02-026.

A copy has been mailed First Class U.S. Mail and e-mailed to all known parties of record in the proceeding who have provided addresses.

Executed in Santa Monica, California, on the 13th day of December, 2004.



Sabrina D. Venskus