FOR THE RECORD

Half-truths, Errors and Omissions Propel Current "Nuclear Revival"

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> He takes apart even the form of matter itself, he strips energy from mass, he splits what is whole, he takes this force for his own, he says. But what he has split does not stop coming apart. Fractures live in the air, invisible fractures come into his body, split his chromosomes, unravel the secrets in him.
>
> —Susan Griffin[1]

> If you tell a lie big enough and keep repeating it, people will eventually come to believe it.
>
> —Joseph Goebbels

For the last ten years, we've been hearing more and more about the revival of nuclear power, a technology that from the mid-1980s had become a pariah and was widely assumed to be on its way out. Initially sold to the public as a clean, cheap, abundant, and safe source of electricity—the "peaceful" prosperity-enhancing side of the devastating horror of atomic bombs—the reality of nuclear power turned out to be something very different. Cost overruns on building nuclear reactors—what initially curtailed the first wave of the commercial nuclear power industry—prompted the executive editor of *Forbes* magazine in 1985 to declare America's experience with nuclear power "the largest managerial disaster in business history."[2] With $125 billion invested, editor James Cook wrote,

> …only the blind, or the biased, can now think that most of that money has been well spent. It is a defeat for the U.S. consumer and for the competitiveness of U.S. industry, for the utilities that undertook the program and for the private enterprise system that made it possible.

These words were published a little over a year before the Chernobyl accident undeniably demonstrated the catastrophic possibilities of "the peaceful atom" and forced the evacuation of 1,000 square miles around the plant;[3] contaminated tens of thousands of square miles in northern Ukraine, southern Belarus, and the Bryansk region of Russia;[4] and sent plumes of radiation over significant portions of Europe[5] and then throughout the northern hemisphere.[6] Chernobyl fallout still prohibits the consumption of milk and meat

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[1] Susan Griffin, *Woman and Nature: The Roaring Inside Her* (San Francisco: Sierra Club Books, 1978), p. 136.
[2] James Cook, "Nuclear Follies," *Forbes*, February 11, 1985.
[3] "Chernobyl's Deadly Footprint," map, *National Geographic*, April 2006, online at: http://ngm.nationalgeographic.com/ngm/0604/feature1/map.html.
[4] Richard Stone, "The Long Shadow of Chernobyl," *National Geographic*, April 2006, online at: http://ngm.nationalgeographic.com/print/2006/04/inside-chernobyl/stone-text.
[5] Terry Macalister and Helen Carter, "Britain's Farmers Still Restricted by Chernobyl Nuclear Fallout," *Guardian*, May 12, 2009, online at: http://www.guardian.co.uk/environment/2009/may/12/farmers-restricted-chernobyl-disaster.
[6] Ian Fairlie and David Sumner, "The Other Report on Chernobyl: An Independent Scientific Evaluation of Health and Environmental Effects 20 Years after the Nuclear Disaster Providing Critical Analysis of a Recent Report by the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO),"

from certain farms in England, Wales, and Scotland,[7] and restrictions remain on consuming various livestock animals, wild game, wild mushrooms, and berries from areas in Sweden, Finland, Germany, Austria, Italy, Lithuania, and Poland.[8]

But with the enormous pressure to expand the current global nuclear fleet of 436 operating reactors to 958 by 2030,[9] we don't hear much about the ongoing devastation wrought by the Chernobyl accident. A new narrative has taken hold, one that downplays the health and environmental impacts of Chernobyl and instead apportions more blame for the health problems of those in the fallout region on emotional factors like stress, poverty, and bad habits such as a poor diet, smoking, and drinking too much.[10]

As concern and information in scientific circles about global warming grew throughout the 1980s, numerous sources—some quite surprising, like former U.S. Senator Timothy Wirth of Colorado, a long-time environmental advocate[11]—began to call for reviving nuclear power as part of the solution. Throughout the second half of his sixteen-year tenure as director general of the International Atomic Energy Agency (IAEA), Hans Blix repeatedly cast nuclear power as a carbon-free energy source that would be needed to combat global warming.[12] (Blix later, as head of the UN Monitoring, Verification and Inspection Committee charged with evaluating Iraq, accused the administration of George W. Bush of hyping Iraq's alleged weapons of mass destruction to justify the 2003 invasion.) By the late 90s, the nuclear industry had become comfortable with its new, self-anointed green identity, and it began casting itself as the clean, green "fresh air" energy source, with

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report commissioned by Rebecca Harms, MEP, Greens/EFA in the European Parliament, Berlin, Brussels, Kiev, April 2006, online at: http://www.chernobylreport.org/?p=downloads.

7 Macalister and Carter, Britain's Farmers Still Restricted by Chernobyl Nuclear Fallout."

8 I. Fairlie and D. Sumner, "The Other Report on Chernobyl."

9 See "World Nuclear Power Reactors & Uranium Requirements," February 1, 2010, World Nuclear Association, online at: http://www.world-nuclear.org/info/reactors.html. The current global fleet generates 372,693 MWe of electricity. Fifty-three reactors are currently under construction in thirteen countries (20 in China, nine in Russia, six in India, and five in South Korea), another 142 are either on order or planned, and 327 more are proposed.

10 Karen Charman, "Brave Nuclear World? Radiation, Reliability, Reprocessing—and Redundancy, Second of Two Parts," *World Watch*, Vol. 19, No. 4, July/August 2006, pp. 12-18. A widely quoted report by The Chernobyl Forum, a group convened by the International Atomic Energy Agency in February 2003 that includes representatives from seven United Nations agencies as well as Belarus, Russia, and Ukraine, concluded that the deaths of only 50 people could be attributed to the Chernobyl accident and that ultimately only 4,000 would die as a direct result. See "Chernobyl's Legacy: Health, Environmental and Socio-economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine," The Chernobyl Forum 2003-2005, online at: www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf. Independent Chernobyl experts, Chernobyl relief agencies, and environmental organizations strongly criticize the Chernobyl Forum report for downplaying the health and environmental impacts of the accident, containing "provably false" statements, contradicting earlier data, and basing some of its conclusions on research that was biased for "financial, political, or legal reasons." See Chernobyl.info, a web-based information clearinghouse on Chernobyl provided by the Swiss Agency for Development and Cooperation in partnership with the UN Office for the Coordination of Humanitarian Affairs (OCHOA), and the UN Development Program (UNDEP), both of which also participated in the Chernobyl Forum. Online at: http://chernobyl.info/index.php?userhash=547341&navID=21&lID=2.

11 "Nuclear Opponents Combat Wirth Bill Provisions," *Nuclear News*, November 1988.

12 See, for example, "Blix Urges U.N. to Push for Wider Nuclear Use," *Nuclear News*, December 1988; "Blix Speaks Out Again on Greenhouse Effect," *Nuclear News*, January 1989; Simon Rippon, "Is it Time to Emphasize the Nuclear Role?," *Nuclear News*, July 1989; "Hans Blix: Great Progress in Nuclear Safety," *Nuclear News*, November 1997.

full page ads in major U.S. newspapers like *The New York Times* and *The Washington Post*, and magazines such as *The Atlantic Monthly* and *The New Republic*. Despite the fact that the Better Business Bureau ruled that these ads were deceptive,[13] the repetition of the message equating nuclear energy with environmental benefits began to take hold, and it now seems to be accepted by policymakers all over the world, much of the corporate media,[14] and a largely disengaged public.

However, the ubiquity of the message that an expansion of nuclear power is needed to prevent catastrophic climate change doesn't mean that it's true. An influential and widely quoted report by the Massachusetts Institute of Technology, "The Future of Nuclear Power," which analyzes a global growth scenario predicated on the construction of 1,000 to 1,500 new 1,000 MWe reactors by 2050, says such an expansion would potentially displace 15-25 percent of the expected *growth* in carbon emissions from electricity projected over that time.[15] Since carbon emissions need to be drastically *cut* from current levels—and not just grow slower—even such a massive expansion as that considered by the MIT report would not achieve that goal.

The MIT report also points out that disposing of the high-level waste created by 1,000 1 GWe[16] light water reactors would require a new waste repository with the capacity of Yucca Mountain to be built "somewhere in the world every three to four years."[17] If history is any indication, there is zero chance of that. In the case of Yucca Mountain, after more than two decades of legal wrangling and at least $9 billion in taxpayers' money spent on the site, Yucca Mountain has been taken off the table.[18] Equally pertinent is that after more than 50 years of commercial nuclear power production, no country has yet completed even one permanent geologic repository, though Sweden—after years of very deliberate public consultation—is closest and expects its underground waste site to be up and running in 2023.[19]

Despite these and other problems, such as the connection to increasing the amount of material available for making nuclear bombs at a time of rising tensions and global political instability, the nuclear train appears poised to leave the station once again. It is safe to assume that this has everything to do with the need to save global capital from the intractable contradictions posed by climate change and the carbon-based economy. In any

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13 Scott Allen, "Nuclear Power Ads Hit as Misleading," *The Boston Globe*, December 10, 1998, p. A16; "Business Bureau Takes on Nuclear Industry's 'Clean Energy' Campaign," *Electric Utility Week*, December 14, 1998, p. 5.

14 Karen Charman, "Nuclear Power Gets Media Makeover," *Extra!*, August 2001, pp. 23-26.

15 John Deutsch, Ernest Moniz, S. Ansolabehere, Michael Driscoll, Paul Gray, John Holdren, Paul Joskow, Richard Lester, and Neil Todreas, "The Future of Nuclear Power," Massachusetts Institute of Technology, 2003, p. 26. An update to this report in 2009 did not change this assessment.

16 1 GWe = 1,000 MWe.

17 Deutsch, et al., "The Future of Nuclear Power," p. 10.

18 John J. Fialka (*ClimateWire*), "The 'Screw Nevada Bill' and How it Stymied U.S. Nuclear Waste Policy," *The New York Times*, May 11, 2009, online at: http://www.nytimes.com/cwire/2009/05/11/11climatewire-the-screw-nevada-bill-and-how-it-stymied-us-12208.html.

19 After 20 years of consultations with the Swedish public, in June 2009, the Swedish Nuclear Fuel and Waste Management Company, SKB, decided to site the final repository for the country's spent nuclear fuel at the three-unit Forsmark nuclear power station in Östhammar. "SKB Selects Forsmark for the Final Repository for Spent Nuclear Fuel," SKB press release, June 3, 2009, online at: http://www.skb.se/Templates/Standard____26400.aspx.

event, it has nothing to do with the merits and especially the safety of nuclear power, a question that the industry has succeeded in obfuscating. So far—even with the vast amounts of public money going to underwrite the new nuclear plants during this time of profound economic crisis and instability—the American public seems to more-or-less be taking the industry's long yearned for nuclear revival in stride. Perhaps this is due to the combination of a widely shared sense of overwhelm, powerlessness, confusion, and sheer fatigue over thinking about the deluge of seemingly intractable problems facing humanity today. In any case, mass ignorance about the impact of nuclear technology on the planet since the dawn of the nuclear age in the mid-1940s plays into the current "acceptance"—or at least lack of widespread public outrage.

The one topic that would inform a real public debate is virtually absent from the discussion. That topic is radiation exposure, the mere mention of which, these days, seems to be considered eye-rollingly passé and/or paranoid. Yet the real history of radiation exposure and its consequences since nuclear technology was unleashed is largely unknown by the public. Nevertheless, an honest examination of this history and the current policies regarding radiation exposure is imperative not only for our health and well-being, but also for consideration of what to do with existing nuclear installations and whether to sign on to more nuclear technology.

Basic Radiation Physics

It's impossible to grasp the history and current risks from nuclear technology without an understanding of the basic principles of the physics of radiation exposure, something nearly always obfuscated in discussions of radiation risks. Here are the basics: Stable atoms are composed of negatively charged electrons that orbit a nucleus that has the same amount of protons. The nucleus also contains neutrons, which act as the glue that keeps the nucleus together. Unstable atoms, also known as radioisotopes or radionuclides, seek stability by giving off particles and energy—ionizing radiation—until the radioisotope becomes stable.[20] This process takes place within the nucleus of the radioisotope, and the shedding of these particles and energy is commonly referred to as "nuclear disintegration."[21] Nuclear radiation expert Rosalie Bertell describes the release of energy in each disintegration as "an explosion on the microscopic level."[22]

In this process, known as the "decay chain," most radioactive elements transform into a number of different elements, also known as "daughter products," (some much more dangerous than the original radioisotope) before becoming a lighter, stable element at the end of the chain. For example, in its decay sequence, uranium-238, the raw uranium that is concentrated, or "enriched," to make nuclear fuel for reactors, turns into thorium-234, then protactinium-234, uranium-234, thorium-230, radium-226, radon-222, polonium-218, lead-214, bismuth-214, polonium-214, lead-210, bismuth-210, and polonium-210 before ending

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[20] Harvey Wasserman and Normon Solomon, with Robert Alvarez and Eleanor Walters, *Killing Our Own: The Disaster of America's Experience with Atomic Radiation* (New York: Delacorte Press, 1982), p. 270.
[21] One common unit of measure of radioactivity is the curie, which equals 37 billion disintegrations per second.
[22] Rosalie Bertell, *No Immediate Danger: Prognosis for a Radioactive Earth* (London: The Women's Press, Ltd., 1985), p. 19.

up as lead-206, which is stable.[23] In the case of U-238, this process takes approximately 28 billion years for just half of it to turn into non-radioactive lead.[24]

Different radioisotopes give off different kinds of radiation—alpha, beta, gamma, X ray, or neutron emissions—all of which behave differently. Alpha-emitters, such as plutonium and radon, are intensely ionizing but weakly penetrating and generally can't get through the dead layers of cells covering skin. But when they are inhaled from the air or ingested from radiation-contaminated food or water, they emit high-energy particles that can do serious damage to the cells of sensitive internal soft tissues and organs.[25] The lighter, faster-moving beta particles can penetrate far more deeply than alpha particles, though sheets of metal and heavy clothing can block them. Beta particles are also very dangerous when inhaled or ingested. Examples include strontium-90 and tritium, a radioactive form of hydrogen.[26] Gamma radiation is a form of electromagnetic energy, which enables it to pass through clothing and skin straight into the body. A one-inch shield of either lead or iron, or eight inches of concrete are needed to stop gamma rays,[27] examples of which include cesium-137 and cobalt-60. Aside from use in medical diagnostics, X rays are also produced in nuclear fission, and their effects are similar to gamma radiation. Neutron emissions are the most penetrating of all types of radiation and require a shield of several feet of water or concrete to contain them.[28]

Radioisotopes that get out into the environment can behave in many different ways depending on what they encounter. They can combine with one another or with stable chemicals to form molecules which may or may not be soluble in water. They can combine with solids, liquids, or gases at ordinary temperature and pressure. They may be able to enter into biochemical reactions, or they may be biologically inert.[29] Bertell notes that if they enter the body either through air, food, water, or an open wound,

> They may remain near the place of entry into the body or travel in the bloodstream or lymph fluid. They can be incorporated into the tissue or bone. They may remain in the body for minutes or hours or a lifetime.[30]

She further notes that

> Plutonium is biologically and chemically attracted to bone as is the naturally occurring radioactive chemical radium. However, plutonium clumps on the surface of bone, delivering a concentrated dose of alpha radiation to surrounding cells, whereas radium diffuses homogeneously in bone and thus has a lesser localized cell damage effect. This makes plutonium, because of the concentration, much more biologically toxic than a comparable amount of radium.[31]

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23 See "Uranium: Its Uses and Hazards," IEER Fact Sheet, Institute for Energy and Environmental Research, online at: http://www.ieer.org/fctsheet/uranium.html.
24 Wasserman, et al., *Killing Our Own*, p. 270.
25 *Ibid.*, p. 271.
26 *Ibid.*
27 *Ibid.*
28 *Ibid.*
29 Rosalie Bertell, *No Immediate Danger*, p. 21.
30 *Ibid.*
31 *Ibid.*, p. 22.

Specific health effects from internal radiation exposure correlate with where radioisotopes land in the body.

> For example, radionuclides lodged in the bones can damage bone marrow and cause bone cancers or leukaemia, while radionuclides lodged in the lungs can cause respiratory diseases. Generalized whole body exposure to radiation can be expressed as a stress related to a person's hereditary medical weakness. Individual breakdown usually occurs at our weakest point.[32]

The complexity of the physics and chemistry of radionuclides and their behavior and impact on the environment and human health has made it relatively easy for nuclear advocates (deliberately or not) to deceive ordinary citizens about the damage inflicted by radiation exposure. The nuclear industry trade press is replete with dismissals of the dangers of radiation exposure. Such concerns have been characterized as "irrational fear."[33] Doses from hypothetical accidents[34]—even Chernobyl—have been minimized as little more than what people would receive from background radiation,[35] or they have been equated with exposure from a single chest X ray, thereby ignoring the damage that can result from inhaling or ingesting microscopic alpha or beta particles. Some nuclear proponents, such as author Richard Rhodes, claim that plutonium is not dangerous, because a piece of paper can block its radiation.[36] However, that claim is meaningless, since most people do not run around with pieces of impenetrable paper over their mouths or noses to block inhalation of microscopic particles of plutonium that may be floating around in the environment.

Aside from neglecting to acknowledge and differentiate key components of radiation exposure, nuclear proponents tend to downplay the danger. For example, despite the fact that on the day of the accident, hundreds of people living near the Three Mile Island nuclear plant reported various symptoms of radiation poisoning—a metallic taste in the mouth; instant "sunburn" on skin not covered by clothing; blisters on the lips and/or inside the nose; vomiting; diarrhea, which in some cases lasted for months; or loss of all their hair[37]—the nuclear industry and the government continue to insist that nobody outside the boundaries of the plant was exposed to any more radiation than a chest X ray. Therefore, the government and nuclear industry say, any health problems following the accident that people near the

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32 *Ibid.*

33 See, for example, Simon Rippon, "'Radiophobia' in the Chernobyl Region," *Nuclear News*, November 1988; T.R., "Fallout of Fear," *Nuclear News*, June 1997; Richard Wilson, "Probability of Causation: Its Use in Compensation Schemes," *Nuclear News*, June 2001; Mark M. Hart, "Disabling the Terror of Radiological Dispersal, *Nuclear News*, July 2003; and "Leo Wainhouse: First Responders and Training for WMD Events," interview, *Nuclear News*, July 2005.

34 Michael J. Slobodien, "Why Indian Point Nuclear Plant is Safe," *Nuclear News*, May 2003.

35 "Paul DeLuca: On Health Physics," interview, *Nuclear News*, June 2006.

36 Richard Rhodes (reporter) and Jon Palfreman (producer), "Nuclear Reaction," *PBS Frontline*, April 22, 1997.

37 Author interview with Three Mile Island area resident Mary Osborne at her home in Harrisburg, Pennsylvania on February 21, 1999; author interview with TMI area resident Jane Lee at her home in Middletown Pennsylvania on March 28, 2004; letter from Pennsylvania State Representative Stephen Reed to NRC Chairman, Joseph Hendrie, August 9, 1979. See also S. Wing, D. Richardson, D. Armstrong, and D. Crawford, "A Re-evaluation of Cancer Incidence Near the Three Mile Island Nuclear Plant," *Environmental Health Perspectives*, Vol. 105, No. 6, January 1997, pp. 52-57.

plant experienced are due to emotional factors like stress, poverty, and bad habits such as a poor diet, smoking, and drinking too much.[38]

Unfortunately, the question of deliberate deception looms large in the history of the atomic age. Bertell maintains that those who held sway in the ranks of the government developers of nuclear technology—first bombs and later the many non-military applications that permitted them to disassociate nuclear technology from war and violence—made the deliberate decision to *not* collect the necessary data to study the effects of the radiation initially released with the bomb tests.[39] No doubt, this would have required a massive effort involving comprehensive, long-term health studies of populations in fallout zones both before and after atmospheric and later underground atomic bomb tests, along with accurate monitoring of radiation doses and comprehensive tracking of radionuclides in the environment. This methodology should also have been applied to populations surrounding all nuclear installations—uranium mines, mills and enrichment facilities, weapons labs and factories, nuclear power plants, nuclear waste dumps, reprocessing facilities, and any other site that hosted nuclear activities. Instead, the U.S. government, which had developed this technology without the knowledge or democratic consent of its citizens, not only chose to proceed without collecting the data, but also deliberately put both its own soldiers and citizens at risk—an astounding and horrifying tale documented in Bertell's book as well as Wasserman and Solomon's *Killing Our Own*—and then denied both the harm and any treatment for resulting illnesses. Some 300,000 American soldiers were sent in to observe bomb blasts at the Nevada Test Site—some waiting as close as 7,000 yards from the blast site before being sent to ground zero an hour or so after detonation.[40]

The Marshall Islanders were also subjected to massive radiation exposure and resulting illness from the 67 atmospheric bomb tests by the U.S. in the Pacific from June 1946 to August 1958.[41] After the tests began, women reported giving birth to masses of tissue that looked like a clump of grapes[42] that just dissolved. In at attempt to deflect responsibility for the high level of severely deformed babies, mental retardation, and stunted children, the U.S. Department of Energy in 1978 prepared a pamphlet with drawings of a Down's syndrome girl and a boy missing most of his left forearm and hand that explained these and other deformities as naturally inherited from their parents.[43] The government did send in researchers, mainly from Brookhaven National Labs on Long Island, to monitor the Marshallese's health;

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38 Author interview with Victor Dricks, U.S. Nuclear Regulatory Commission Press Office, February 19, 1999; see also Thomas Pawlick, "The Silent Toll," *Harrowsmith*, June 1980, pp. 33-49; Mary Dalrymple, "Science on the Firing Line," *Endeavors Magazine*, Fall 1997, online at: http://research.unc.edu/endeavors/aut97/wing.html; and Harvey Wasserman, "Three Mile Island: Exposing the Government's Cover Up of Our Most Infamous Nuclear Accident," *AlterNet*, March 30, 2009, online at: http://www.alternet.org/environment/134174/three_mile_island:_exposing_the_government%27s_cover_up_of_our_most_infamous_nuclear_accident/.

39 Bertell, *No Immediate Danger*, p. 78.

40 Wasserman, et al., *Killing Our Own*, p. 69.

41 See: http://www.nuclearclaimstribunal.com/testing.htm.

42 Barbara Rose Johnston and Holly M. Barker, *Consequential Damages of Nuclear War: The Rongelap Report* (Walnut Creek, CA: Left Coast Press, 2008), p. 14.

43 *Ibid.*, plate 25.

however, the Marshallese were not offered treatment, and it took until 1988 before a tribunal was even established to deal with claims for compensation.[44]

The cases of nuclear weapons testing and power plants are not identical, though a climate of cover-up, denial, and minimization operates regarding both. Without the actual data that was and still is deliberately not collected, we can't know the full extent of the harm that has been done from either, nor that which looms. Bertell, a former senior cancer researcher at the Roswell Park Cancer Institute in Buffalo, New York and long-time investigator into the dangers of radiation, says that radiation can damage health in myriad ways, and that there are big differences in the susceptibilities among people that also depend on how old they are when they are exposed.[45] Besides initiating cancers, radiation can damage people's immune systems, which can manifest in numerous ways, like an increase in allergies, autoimmune diseases like lupus, or perhaps more subtly in someone just not being as healthy as he or she would have been without the radiation exposure.[46] It can also lead to birth defects, and once radiation alters the DNA, the damage passes down through the generations.[47]

Nobody lives in a vacuum nor is exposed to just one thing. Unfortunately, the world we inhabit is permeated with a wide array of synthetic, and in many cases toxic, agents that humans and other living creatures did not evolve with. This is not the place to take up the immensely complex epidemiological question of the changing character and prevalence of disease patterns. However, we must acknowledge both the great array of novel and disabling diseases that have appeared over the past half-century and their connection to the ecological crisis as a whole, a crisis brought about by the destabilization of the ecosphere by capital accumulation. Clearly, the case of nuclear power belongs in this picture.

It is quite conceivable that the massive radiation exposures unleashed since the nuclear age began in 1943 are playing a significant role in the changing patterns of illness in society. And as we continue the nuclear experiment and contemplate adding considerably to the world's existing fleet of nuclear reactors as well as expanding highly radioactively polluting activities such as fuel reprocessing, society would do well to thoroughly and dispassionately analyze the effects of human-generated nuclear radiation on the citizenry and the natural world. Unfortunately, nuclear advocates aren't willing to even entertain the thought, let alone ask the necessary questions.

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44 See: http://www.nuclearclaimstribunal.com/hist.htm.

45 Bertell, *No Immediate Danger*, p. 63.

46 *Ibid.*, p. 50.

47 *Ibid.*, pp. 41-44.