

**Growing Up Under the Shadow of the Bomb:
Recollections of a Nuclear Technologist***

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For presentation at *The Atomic Bomb and American Society Conference*

Doubletree Hotel, Oak Ridge TN
July 15–17, 2005

*Based on work performed at Oak Ridge National Laboratory managed for the U.S. Department of Energy by UT-Battelle, LLC, under Contract DE-AC05-00OR22725

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Purpose of Presentation

Esteemed colleagues and guests. At this conference we are dealing with the effects of the development and use of nuclear weapons on American society. Six years ago, a conference entitled “History of Atomic Projects” (HISAP-99) was held near Vienna, Austria, where Russian and Western scientists and engineers discussed atomic energy developments in the 1950s with the emphasis on their technical missions and the facilities and cities within which they were undertaken. At that conference, I presented a first technical paper on the *History of Uranium Enrichment*. At this meeting, I also discussed the societal implications of such weapons-related work, which took place in the early years of the Cold War. I thought that this “societal implications” topic was deserving of a paper, especially since I have a non-work-related interest in this area of “nuclear history”. Based on this second paper that I presented at HISAP-99, I would like to discuss the cultural and societal background associated with nuclear weapons and atomic energy in the 1950s, and I will do this from two viewpoints. The first, which is only a short summary, is from the viewpoint of historians who have documented the cultural background of the early Cold War years; the second is from my own personal recollections as a 4- to 14-year-old child growing up during this period 1950 to 1960. Having been interested in science since the mid-1950s, my recollections and viewpoints in these early years may differ significantly from those of my nontechnical contemporaries. I should also note, based on conversations at the 1999 conference, that my recollections were certainly different from those of Russians in my same age group! I will conclude with a discussion on how the cultural background of the 1950s and 1960s, which affected many of today’s leaders and decision makers who were then children, is still affecting public attitudes toward nuclear energy today.

Books on This Subject by American Authors

I should first point out that less literature exists on the nuclear technical achievements of the 1950s and their cultural backdrop than for the 1940s. Dozens of books have been written about the pioneering atomic energy research and development work of the late 1930s through the mid-1940s (World War II years) and the impetus given to this early work (Manhattan Project) by concern over possible concurrent atomic energy work in Germany and the need to end the Second World War. One such notable book, which was the winner of a Pulitzer Prize, is *Making of the Atomic Bomb* (1986) by Richard Rhodes. His second book, *Dark Sun: The Making of the Hydrogen Bomb* (1995), also covers this period and how fission bomb work in the 1940s ultimately led to the development of thermonuclear weapons in both the United States and the Soviet Union in the 1950s. More recently, the historians Paul Boyer and Margot Henriksen have attempted to document the cultural milieu of atomic weapon development and deployment with

an emphasis on American public and media reaction to nuclear weapons-related events rather than documenting foreign policy or geopolitical responses to these events. Three such books are *By the Bomb's Early Light, American Thought and Culture at the Dawn of the Atomic Age* and *Fallout: A Historian Reflects on America's Half Century Encounter With Nuclear Weapons*, both by Boyer, and *Doctor Strangelove's America* by Henriksen. My reading of some of this literature has confirmed, in most cases, the cultural backdrop of many of my recollections; therefore, I will briefly mention some of these authors' general observations as providing some historical context for my personal recollections.

Cultural Reactions to the Bomb

The postwar period of the 1940s saw a movement among many scientists, religious leaders, intellectuals, and politicians toward the need for international control of atomic energy and even toward world government in some form. The explosion of the first Soviet bomb in 1949, however, began to change the general attitude of the U.S. public from one of concern over control of atomic weaponry to one of competition with the Soviet Union. The strong arms control movement of the late 1940s dwindled as the Cold War began in earnest, and the race was on for larger and more advanced "hydrogen" or "thermonuclear" weaponry. From 1949 to the late 1950s, the American public seemed resigned to an inevitable continuing arms race with the Soviet Union and increasing nuclear stockpiles. The public and media attitude changed from one of implicit approval to one of genuine concern, however, when the issue of detrimental health effects due to the fallout from atmospheric nuclear testing came to the forefront in the late 1950s. This concern ultimately led to the Limited Test Ban Treaty in 1963. Because professional historians have already done so and because this talk is oriented toward personal recollections from the 1950s, I will not deal with the ebb and flow of public reactions to the Nuclear Arms Race from the early 1960s to the present.

Personal Recollections on the Cold War and the Bomb

As a 9-year-old child in 1955, I remember conversations with my peers about "bomb" tests of ever-increasing megatonnage, and I remember concern over whether we were keeping up with the Russians. The announcement years later concerning the 1961 explosion of a 58-megaton H-bomb by Russia in Novaya Zemlya is an event I also remember vividly. One young friend of mine even spoke of hearing of a "cobalt bomb" that "could blow the earth in half." I can remember being concerned whether the US was "keeping up" with Russia in the weapons area. My elementary education took place in a parochial school in the Chicago, Illinois, area. By the late 1950s, civil defense was beginning to become part of U.S. policy toward the threat of atomic war. I remember at least once crawling under my school desk for an "air-raid" drill and hearing about the radio-based CONELRAD system for notifying and instructing the public about impending atomic attacks. School curricula during this time, especially in Chicago-area church-related schools with many second-generation Eastern European families, emphasized the spread of communism and its threat to the American way of life. In the later 1950s, I recall the concern about "something bad in milk that came from the sky." This refers of course to the strontium-90 fission product deposited as fallout from U.S. and Russian atmospheric bomb tests, which

ultimately found its way into milk via deposition on plant materials consumed by cows. Fortunately, the 1963 Limited Test Ban Treaty, which ended U.S. and Soviet atmospheric testing, put an end to this very real health concern.

Effects of Perceived Russian Technology Lead on American Education

Competition with the Soviet Union in the area of space technology, in addition to nuclear weapons technology, had some nonmilitary benefits to the country. I can remember vividly spending the night at a friend's home and hearing on the television news about the Russian launch of the Sputnik-1 earth-orbiting spacecraft in October 1957. As an 11-year-old who had just become interested in science, especially astronomy and physics, the fact that the US had been "beaten" in this area was a real blow. Little did I know what a large impact this would have on my future education in junior and senior high school. The perceived gap in U.S. atomic, missile, and space exploration technology began a massive effort to improve science and mathematics education in the US. By the seventh grade (age 12), we were studying the "New Math" with its emphasis on set theory, number lines, algebraic theorems, and geometric concepts. (The "Old Math" was more concerned with the rote learning of numerical manipulation and the "how's" of problem solving rather than the "why's") Science education changes in high school were even more dramatic. The emphasis in many ninth- and tenth-grade biology classes shifted from descriptions and anatomy of the various classes of organisms to one dealing with concepts central to living things such as cell biochemistry, genetics, and evolution. I remember preparing the final paper of my biology class on the "Unifying Concept of the Protoplasmic Stream." As a now-practicing physical rather than life scientist, I can only remember that this paper had something to do with genetics and evolution as the central organizing concept in biology, and the subject we were all given for this paper had an impressive-sounding title. The teaching of chemistry was also shifted from descriptive chemistry, which dealt with elements and compounds and their physical and chemical properties and uses, to a centralizing concept of chemistry based on understanding the nature of chemical bonds. The name of this new approach to chemistry was indeed called the "Chemical Bond Approach" or "CBA" Chemistry. Textbooks were filled with conceptual diagrams of electronic "orbitals" or "charge clouds" that were used to explain chemical and physical properties and the potential for chemical reactions based on chemical bonding possibilities. Emphasis was again on centralizing physical concepts rather than on chemical substances and their properties. High school physics also underwent similar changes with the introduction of "Physical Science Study Commission" (PSSC) physics. Rather than emphasizing the memorization of physical laws, the PSSC concepts dealt with the procurement of experimental data and its confirmation of the mathematical derivation of these laws. As examples, soap films on the surface of water were used to conceptually derive Avogadro's number, and "wave tanks" and stretched-out "Slinky springs" were used to simulate the behavior of electromagnetic and sound waves. The new physics approach was the best of these new concepts and prepared me well for university-level physics, both classical and modern, and its calculus-based approach. Another science teaching tool that still persists, but in a less-emphasized form, is the science fair. Science fairs are events in which students prepare and display "science projects" in a particular field such as astronomy, biology, and physics. In the late 1950s and early 1960s, such events were highly publicized and emphasized, with high school cafeterias or gymnasiums often filled with hundreds of projects by

students both aspiring and not aspiring to scientific careers. Typical projects more often proved to be models or explanations of scientific concepts rather than the results of true experiment-based research. Models of human hearts, volcanoes, and miniature solar systems were very common. I cannot verify that all of the above educational changes produced a greater number of scientists and engineers in the 1960s and 1970s; however, I am convinced that such approaches and activities did better prepare budding scientists and engineers for their university educations and future research and development careers.

Recollections of Popular Culture

Popular culture in the 1950s was also strongly affected by the nuclear arms race and the possibility of “Atomic Doom.” Boyer and others explore these influences in detail in their books, which contain many media excerpts from books, songs, and poetry of that period. What I remember most vividly as a child in the 1950s are the science fiction films of that era. Many Saturday afternoons, my friends and I would walk to the local cinema in downtown La Grange, Illinois, pay our 25 cents, and partake of the “double feature” — one of which was usually a science fiction or horror film. Many of the science fiction films of that era dealt with some fictional, but horrible, biological or social consequence of atomic warfare, atomic testing, or nuclear research. Typical of such films was the production of a giant insect or other unlikable or destructive animal by ionizing radiation-induced genetic mutation. After exposure to ionizing radiation, such creatures or their offspring would often reappear in linear dimensions ten to one thousand times their normal size (despite the fact that biological and physical principles obviate such huge increases in scale). Because of the location of my hometown, I remember most vividly the film “Beginning of the End” (1957). In this film, an accident at an agricultural research facility near Chicago causes the genesis of 20-ft grasshoppers that take over downtown Chicago. Another film was “Them” (1954), which dealt with giant ants in the Southwest US produced by nuclear testing. Interestingly, many of these films were produced in Japan, which for obvious reasons underwent much greater atomic “angst” than in most nations. An example of a Japanese film was “Rodan” (1956) in which a giant pterodactyl was reawakened by atomic testing in the Pacific. I could go on and describe many other such films, some even produced more recently such as the remake of “Godzilla”; however, I perhaps should not introduce comedy or reviews of “B-movies” into a serious subject. Other science fiction films dealt with a postnuclear holocaust world and its inhabitants. Among these were the “Time Machine” (1960), based on an H. G. Wells’ science fiction story, and “On the Beach” (1959). Interestingly, the English author, H. G. Wells, had in the second decade of the 20th century (1914) predicted the development of a new source of energy leading to “The Last War.” (His book is titled, *The World Set Free*.) Not all of the media, however, dealt with the negative consequences of atomic energy. I remember documentary television programs dealing with the concept of nuclear fission and the many uses that might be made of it. A vivid recollection from one such series of programs, *Our Friend the Atom* by Walt Disney productions, was a model of the nuclear fission process consisting of hundreds of spring-type mousetraps and small, hard balls. Each mousetrap, which was supposed to represent a U-235 atom, was cocked with two small balls carefully placed on the U-shaped lethal end of the trap that flips over and kills the mouse. Each ball represents a neutron. After hundreds of such traps and balls are set, a ball is thrown into the room, which in essence sets off a cascade of snapping traps and catapulted balls simulating a

nuclear chain reaction. Even before I was interested in nuclear science I found this demonstration interesting and memorable! The same program dealt with benefits, such as nuclear power plants, naval vessels, and the use of radioisotopes in medicine. The use of radioisotopes in medicine was also beginning in the 1950s. I remember a woman in my neighborhood discussing drinking an “atomic cocktail” while in the hospital. An atomic cocktail was a liquid containing a radioisotope used for diagnostic purposes.

Public Reaction Concerning Nearby Nuclear Facilities

It is also interesting to consider public opinion toward nuclear facilities at that time. Some of the nuclear facilities located near large cities were U.S. national laboratories where the U.S. government decided to focus the future development of atomic energy. Twenty-five miles southwest of downtown Chicago and 11 miles from my former home is the Argonne National Laboratory (ANL), an offshoot of the former Metallurgical Laboratory of the University of Chicago (where the first controlled nuclear reaction took place under a small stadium, Stagg Field, on December 2, 1942). This laboratory was established in a forested rural area near Chicago to conduct further research on nuclear reactors and their fuel cycles. Our family had a few neighbors who worked there, and some of us in the neighborhood had some idea what these employees worked on. One such ANL worker, however, remembers being asked more than once by his neighbors, “How many atom bombs did you make today?” The fact that even nonweapons personnel had security clearances may have led to the idea that all laboratory workers worked on secret weapons projects. (It is common practice for neighbors to be contacted when security clearances are processed or renewed.) There was little or no public fear of contamination or accidents. In the 1950s–1970s, several nuclear reactors were in operation at ANL. Due mainly to budgetary and programmatic changes, none of these are now operating. The public utility in the Chicago area, Commonwealth Edison, was also one of the first utilities to build a nuclear power plant. The Dresden plant, about 50 miles southwest of Chicago, was designed in the late 1950s and was the first of many nuclear power plants that this utility was to build. As a child, I remember the personal excitement of hearing about such proposed nuclear electric power plants and also hearing of the exploits of the *Nautilus*, the first nuclear submarine, commissioned in 1954, including a passage under the North Pole.

Today’s Public Attitude Regarding Nuclear Energy

Many of my contemporaries, especially nontechnologists living far from Oak Ridge, harbor a disparaging attitude toward most things nuclear. I attribute this attitude in part to distrust of government and distrust of large industrial enterprises, perhaps based on the environmental legacy of the Cold War and the Three Mile Island and Chernobyl reactor accidents. I wonder, though, how much “fear of nuclear” among my contemporaries, many of whom are today’s political and industrial decision makers, can be connected to their childhood impressions of nuclear energy from the early Cold War era? Even when beneficial nonreactor uses of nuclear energy are suggested, such as the irradiation of food for preservation, much of the public reacts very negatively. I’m sure that for many the thought of irradiated food brings back images of mutated creatures per the popular films of the 1950s. I am convinced that only when the

immense environmental benefits of nuclear power become a necessity, such as if the effects of greenhouse gas-related global climate change become more obvious or fossil-fuel shortages develop, will the public be willing to accept the perceived risks of nuclear energy. It is interesting to observe that many of the historians of nuclear energy mentioned above are not technologists and dealt mainly with the downside of nuclear energy and the moral issues associated therewith. On the cover jacket of the book *Atomic Spaces: Living on the Manhattan Project*, the author and historian, Peter Hales, decries “technological values, dehumanizing personal relations, and bureaucratic locations” as the legacy left to us by the Manhattan Project and the further development of nuclear energy. When I talk to those technological pioneers of the early days of nuclear energy, many of whom still reside in Oak Ridge, I sense more of a feeling of huge accomplishment and triumph, which cannot be matched in today’s less urgent and more bureaucratic environment. The gathering of “Manhattan Project Veterans” last month at Oak Ridge’s “Secret City Festival” was a manifestation of such pride, as well as the recent completion of a “Commemorative Walk” honoring them. Perhaps, as a technological optimist, I view things differently than many of my early “baby-boomer” colleagues who experienced the atomic angst of the 1950s and the social upheavals (Civil Rights, Vietnam War, and Watergate) of the 1960s and 1970s. I see the development of nuclear energy as one of the crowning accomplishments of the 20th century. In late 1999, even the popular press declared the atomic bomb as the most important historical development of the 20th century. Because the major world powers have understood the huge potential of this technology for good or evil, we have avoided another world war for more than 60 years, and in the greenhouse gas constrained future (which is becoming the second nuclear era), we may have to depend heavily upon nuclear technology for a significant portion of our energy needs.

In closing, I should note that Dr. Alvin Weinberg, an esteemed resident of the Oak Ridge community and a former Director of the Oak Ridge National Laboratory, invented the term “Nuclear Era”. His book *The First Nuclear Era: the Life and Times of a Technological Fixer* (1994) was in many ways an inspiration for the preparation of this paper. Thank you very much for your interest, and I would especially be interested in hearing any of your recollections of the 1950s.