RESOURCE LETTER

Resource Letters are guides for college and university physicists, astronomers, and other scientists to literature, websites, and other teaching aids. Each Resource Letter focuses on a particular topic and is intended to help teachers improve course content in a specific field of physics or to introduce nonspecialists to this field. The Resource Letters Editorial Board meets annually to choose topics for which Resource Letters will be commissioned during the ensuing year. Items in the Resource Letter below are labeled with the letter E to indicate elementary level or material of general interest to persons seeking to become informed in the field, the letter I to indicate intermediate level or somewhat specialized material, or the letter A to indicate advanced or specialized material. No Resource Letter is meant to be exhaustive and complete; in time there may be more than one Resource Letter on a given subject. A complete list by field of all Resource Letters published to date is at the website <http://ajp.dickinson.edu/Readers/resLetters.html>. Suggestions for future Resource Letters, including those of high pedagogical value, are welcome and should be sent to Professor Mario Belloni, Editor, AJP Resource Letters, Davidson College, Department of Physics, Box 6910, Davidson, NC 28035; e-mail: mabelloni@davidson.edu.

Resource Letter MP-3: The Manhattan Project and Related Nuclear Research

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This Resource Letter is a supplement to the earlier Resource Letters MP-1 and MP-2, and provides further sources on the Manhattan Project and related research. Books, review papers, journal articles, videos, and websites are cited for the following topics: general works, technical works, biographical and autobiographical works, foreign wartime nuclear programs and related allied intelligence, the use of the bombs against Hiroshima and Nagasaki, technical papers of historical interest, postwar policy and technical developments, and educational materials. Together, these three Resource Letters describe nearly 400 sources of information on the Manhattan Project. © 2016 American Association of Physics Teachers.

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I. INTRODUCTION

Nuclear issues continue to engage the attention of the scientific community, government policy makers, and the public at large. As this Resource Letter was being prepared, multi-lateral negotiations directed at minimizing the possibility that Iran might develop nuclear weapons were successfully concluded; on the other hand, North Korea detonated its fourth nuclear device and threatened to unleash nuclear attacks. Some countries are working to reduce their reliance on nuclear energy—policies that could have serious implications for addressing climate change—while others seek to address the problems of securely storing nuclear waste and fissile materials. All of these concerns have their geneses, directly or indirectly, with the development of the first generation of nuclear weapons during the World War II Manhattan Project. Two previous Resource Letters on this topic, MP-1\(^1\) and MP-2\(^2\), listed a total of over 270 books, technical papers, articles, videos, and websites dealing with the science, personalities, context, and legacies of the Manhattan Project.

Since the publication of MP-2, many new Manhattan Project-related sources have appeared. These include not only analyses of the physics of the Project and biographies of some of its major personalities but also discussions of Project legacies such as public exposure to radiation (both inadvertent and deliberate), the current world nuclear-arms situation, and analyses of previously unavailable documents concerning the effects of the bombings of Hiroshima and Nagasaki on high-level discussions within the Japanese government regarding that country’s August, 1945, decision to surrender. In addition, educational materials on the Manhattan Project suitable for use in high-school and undergraduate-level curricula are now becoming available. Finally, a number of older sources that predated and should have been included in MP-1 or MP-2 are included here.

Two other recent developments related to the Manhattan Project deserve particular mention. The first is that just after the end of World War II, the Project’s commanding officer, General Leslie Groves, had an extensive multi-volume history of the Project prepared by an aide, Gavin Hadden. This document, the Manhattan District History (MDH), runs to thousands of pages and is a trove of information for Project scholars. The MDH was previously available only on microfilm from the National Archives of the United States, but in late 2013, the Department of Energy began posting it online; see Ref. 109. This release is notable in that some sections, notably those on Los Alamos and the K-25 gaseous diffusion plant at Oak Ridge, were previously unavailable although they remain partially redacted. The second development is that in late 2014, the United States Congress passed the 2015 National Defense Authorization Act, which included a provision to establish a Manhattan Project National Historical Park. The park will include sites at Los Alamos, NM; Hanford, WA; and Oak Ridge, TN. Among the sites to be preserved are the B Reactor at Hanford, the X-10 reactor, and components of the Y-12 “calutron” plant for enriching uranium at Oak Ridge, and the buildings at Los Alamos where the first atomic bombs were assembled. The text of the legislation

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authorizing the park can be found at https://www.congress.gov/bill/113th-congress/house-bill/1208; relevant Department of Energy and National Park Service websites can be found at: http://energy.gov/management/office-management/operational-management/history/manhattan-project/manhattan-project-0 and http://www.nps.gov/mapr/index.htm. In coming years, the National Park Service will develop interpretive materials on the sites, while the Department of Energy will ensure public access, safety, environmental remediation, and historic preservation of sites.

This Resource Letter follows the same format as MP-1 and MP-2, with some slight changes in section titles and one new section. Section II D of MP-2, “Foreign wartime programs and allied intelligence,” is now “Foreign wartime programs, allied intelligence, and the use of the bombs” to reflect inclusion of materials which deal with the use of the bombs in the contexts of the state of the war in mid-1945 and internal Japanese political maneuverings regarding surrender. Section II G, “Educational materials,” is new and includes a few sources which are specifically targeted toward secondary and post-secondary teachers who wish to introduce the Manhattan Project in their course materials.

In all sections, below books are listed first, followed by journal and magazine articles. Sources are in no particular order except that I have made an effort to group works on a given topic and order them chronologically within each topic. As was the case with MP-1 and MP-2, many sources could arguably be assigned to different sections.

II. BOOKS AND JOURNAL ARTICLES

The sources cited below are divided into six categories: (A) General works, (B) Technical and historical works, (C) Biographical and autobiographical works, (D) Foreign wartime programs, allied intelligence, and the use of the bombs, (E) Technical papers of historical interest, (F) Postwar developments, and (G) Educational materials.

A. General works

1. Synoptic overviews


3. The History and Science of the Manhattan Project. B. C. Reed (Springer, Berlin, 2014). This volume covers the physics behind the Manhattan Project at a level appropriate to undergraduate science students and describes the history of the Project from its tentative beginnings in 1939 up through the bombings of Hiroshima and Nagasaki. The last chapter, “The Legacy of Manhattan,” gives a brief description of postwar weapons developments and arms-control treaties up to the New START agreement of 2010. This work is a companion volume to MP-2 Ref. 28, which is now available in a revised edition. (I)

4. Atomic Bomb: The Story of the Manhattan Project. How Nuclear Physics Became a Global Geopolitical Game-changer. B. C. Reed (Morgan and Claypool, San Rafael, CA, as part of IoP Concise Physics, 2015). This book can be considered an abbreviated version of Ref. 3 suitable for upper high-school/ lower-level college students and general-audience readers equipped with a basic background in physics and chemistry. (I)

5. The General and the Genius. Groves and Oppenheimer: The Unlikely Partnership that Built the Atom Bomb. J. Kunetka (Regnery History, Washington, DC, 2015). This book gives a very readable survey of the Manhattan Project. The author’s focus is the personalities of and working relationship between Robert Oppenheimer and General Groves, but of necessity covers the entire Project. (E)


7. “Nuclear weapons at 70: Reflections on the context and legacy of the Manhattan Project,” B. C. Reed, Phys. Scr. 90(8), 088001 (2015). This paper is a sequel to Ref. 6 and reviews the development and proliferation of nuclear weapons, the effects of the nuclear enterprise on individual scientists and international relations, the involvement of scientists with social and political movements in the postwar years, and the status of world nuclear arsenals to 2015. (I)


9. “Why the Manhattan Project should be preserved,” R. Rhodes, Bull. Atom. Sci. 71(6), 4–10 (2015). In this eloquent and powerfully written essay, the author of The Making of the Atomic Bomb and Dark Sun (MP-1 Refs. 7 and 10) argues that artifacts and places associated with the Manhattan Project should be preserved on the rationale that if we lose parts of our physical past, we also lose parts of our common human past. (E)

2. Specific topics within the Manhattan Project

10. The Atomic Bombings of Hiroshima and Nagasaki. The Manhattan Engineer District. This report, dated June 29, 1946, summarizes the results of investigative teams dispatched to Hiroshima and Nagasaki in the weeks following the end of the war. The investigating teams spent 16 days in Nagasaki and four in Hiroshima. Discussions and statistics are presented on the nature of the cities before the bombings; casualties; percentages of structures destroyed; and blast, thermal, and radiation effects on both structures and people. Available online at http://www.atomicarchive.com/Docs/MED. (E)

11. Project Alberta: The Preparation of Atomic Bombs for use in World War II. H. W. Russ (Exceptional Books, Los Alamos, 1990). Project Alberta was that part of the Manhattan Project responsible for assembly and delivery of working weapons. Harlow Russ (1912–1998) was an engineer at Los Alamos who was involved with the design of the Fat Man implosion mechanism and who shipped out to Tinian Island in June, 1945. This well-illustrated volume gives a first-person account of the final preparations of the weapons. (E)
12. Behind Tall Fences: Stories and Experiences About Los Alamos at its Beginning. (Los Alamos Historical Society, Los Alamos, 1996). This book comprises a collection of 21 essays by 18 authors which describe events that occurred at Los Alamos between 1941 and 1951. Many of the authors worked at Los Alamos between 1943 and 1945 on various aspects of the atomic bomb project such as the experimental physics of fast-neutron reactions and cross-section measurements, developing the implosion technique, plutonium metallurgy, and instrumentation for the Trinity test. (E)

13. Images of America: Oak Ridge. E. Westcott (Arcadia, Charleston, SC, 2005). Westcott was an official Manhattan Project photographer, and had complete access to all aspects of life and work at Oak Ridge. This book of his photographs illustrates not only the frantic pace of construction and work at the Clinton Engineer Works, but also scenes of family life, day-to-day activities, and recreation in what became a city of 75,000 people by the end of the war. A website with Westcott’s photos can be found at photosofedwestcott.tumblr.com. See also Refs. 105–107 below. (E)

14. Images of America: Los Alamos 1944–1947. T. M. Gibson and J. Michnovicz (Arcadia, Charleston, SC, 2005). This book is part of the same Images of America series as the Westcott citation above. In October, 1944, Private John Michnovicz arrived as Los Alamos to serve as a photographer. Over the following three years, he took thousands of photos of residents at work and play. This work reproduces several dozen shots of scenery, social and recreational events, pets, and formal portraits of laboratory staff, all captioned. (E)

15. A Guide to the Manhattan Project in Tennessee. C. C. Kelly (Atomic Heritage Foundation, Washington, D.C., 2011). This and Ref. 16 are companion volumes to Refs. 15 and 16 of MP-2. This volume describes Manhattan Project-related sites in Tennessee, concentrating on facilities at the Clinton Engineer Works and Oak Ridge National Laboratory. Well illustrated and includes excerpts from interviews with individuals who were there. (E)

16. A Guide to the Manhattan Project in Washington State. C. C. Kelly (Atomic Heritage Foundation, Washington, D.C., 2011). This companion volume to Ref. 15 describes Manhattan Project sites in the state of Washington. Gives a brief history of the Hanford area, the Hanford Engineer Works; the role of the DuPont Company in the construction and operation of reactors; fuel fabrication and chemical separation; and some sites in the surrounding area such as Boeing’s Renton facility; a Nike missile site; and a Japanese internment camp at Bainbridge Island in Puget Sound. See also Ref. 17. (E)

17. Made in Hanford: The Bomb that Changed the World. H. Williams (Washington State U. P., Pullman, WA, 2011). This book describes how the area around Hanford, Washington, came to be chosen as the site of the Manhattan Project’s plutonium production reactors. In 1943, the author’s father was serving as the editor of the Pasco Herald, a small newspaper in the Hanford area, when he was visited by Lt. Col. Franklin Matthias, commander of the Hanford Engineer Works, who requested that the paper should not run any stories on the project. Williams describes how the town was transformed by the project, the engineering and operation of the reactors, and the effects of nuclear weapons testing on the peoples of the Marshall Islands. Matthias’ diary is available online; see Ref. 99. (E)

18. The Silverplate Bombers. R. H. Campbell (McFarland, Jefferson, North Carolina, 2005). B-29 bombers configured to carry test atomic bombs and the live Hiroshima (Enola Gay) and Nagasaki (Bockscar) bombs were known as Silverplate bombers; 65 such aircraft were manufactured between 1943 and 1947. Campbell describes the history of each aircraft, information on the crews that participated in the Hiroshima and Nagasaki missions, gives a complete roster of Project Alberta personnel, and discusses the eventual disposition of each aircraft. (E)

19. Enola Gay: The B-29 That Dropped the Atomic Bomb on Hiroshima. N. Polmar (Brasseys Inc., Dulles, VA, 2004). This well-illustrated volume is briefer than Ref. 18, but gives some useful specifications on B-29’s including statistics on bomb loads and combat radii, as well as descriptions of the Hiroshima and Nagasaki missions and postwar uses of B-29’s. (E)

20. The Girls of Atomic City: The Untold Story of the Women Who Helped Win World War II. D. Kiernan (Touchstone, New York, 2013). This engaging volume tells the stories of a number of women who worked at Oak Ridge in capacities as varied as secretaries, calutron operators, a chemist, a janitor, a gaseous-diffusion plant leak detector, and a statistician. Kiernan puts human faces on the lives and tribulations of the thousands of employees that kept the huge enrichment facilities of the Clinton Engineer Works operating. (E)

21. Trinity: The History of an Atomic Bomb National Historic Landmark. J. Eckles (Fiddlebike Partnership, Las Cruces, NM, 2015). The author of this book worked in the Public Affairs Office of the White Sands Missile Range in New Mexico, where he conducted numerous public tours of the Trinity site and had occasion to interview many individuals who participated in the test. Eckles describes a number of aspects of the test that are not related in other sources, including discussions of the restoration of the McDonald ranch house; the crater created by the bomb; the Jumbo containment vessel; analysis of radioactivity; the formation and eventual removal of Trinitite; and the disposition of various structures involved with the test. See also Bainbridge’s report on the test (MP-1 Ref. 19) and Merlan’s book on experiments conducted during the test (MP-1 Ref. 21). (E)

22. History of the Dayton Project. K. V. Gilbert (Monsanto Research Corporation, Miamisburg, OH, 1969). In 1943, Charles Thomas, director of the Monsanto chemical company’s research department in Dayton, Ohio, was tasked with developing the chemistry and metallurgy required to produce polonium to be used in the neutron-generating triggers for the bombs being prepared at Los Alamos. This document offers a brief history of the Dayton facility and the work conducted there, and is illustrated with numerous photographs of the facility and members of the staff. After the war, this facility became the Mound Laboratory of the Atomic Energy Commission. Available at http://www.eecap.org/PDF_Files/Ohio/Dayton_Project/History/HISTORY_OF_THE_DAYTON_PROJECT.pdf (E)

began, the only practical process for producing uranium metal was carried out at a Westinghouse lamp plant in New Jersey, where the metal was experimented with for use in filaments. Used to producing ounce amounts, the plant was suddenly asked for tons of uranium for Enrico Fermi’s CP-1 reactor. The Westinghouse process was eventually superseded by one more suitable for large-scale production (Ref. 29), but Westinghouse did provide the CP-1 uranium. The author was then a 16-year-old high-school student who worked as a messenger at the plant; only when the war ended did he come to understand what the plant was producing. (E)

24. “Preparative scale mass spectrometry: A brief history of the calutron,” A. L. Yergey and A. K. Yergey, J. Am. Soc. Mass Spectrom. 8(9), 943–953 (1997). This paper describes the design, operation, productivity, and post-war uses of Ernest Lawrence’s “calutrons” that were built at Oak Ridge to enrich uranium. (I)

25. “Atomic wives and the secret library at Los Alamos,” L. Bier, Am. Libr. 30(11), 54–56 (1999). This article describes the Library at Los Alamos, which was organized and directed by Charlotte Serber. (E)

26. “Analytical chemistry and the Manhattan Project,” F. A. Settle, Anal. Chem. 74(1), 36A–43A (2002). The role of chemists in the Manhattan Project has tended to be overshadowed by the accomplishments of physicists and engineers. Chemists contributed not only to techniques for separating synthesized plutonium from uranium but also to developing techniques and instruments for performing trace-element analyses on toxic and highly radioactive substances in order to ensure that the uranium and plutonium isolated for the bombs would be sufficiently pure. Settle reviews some of the methods involved in this work and describes some of the individuals involved. (I)

27. “People of the Hill: The early days,” H. Mayer, Los Alamos Sc. 28, 4–29 (2003). This article gives a personal description of the history of Los Alamos over its first decade, 1943–1953, with an emphasis on some of the personalities involved. The author, Harris Mayer, has been associated with Los Alamos since 1944, and was particularly involved with equation of state and opacity calculations relevant to the development of thermonuclear weapons. This article was published in the 60th anniversary edition of Los Alamos Science and can be found at: http://la-science.lanl.gov/lascience28.shtml. (E)

28. “From Treasury Vault to the Manhattan Project,” B. C. Reed, Am. Sci. 99(1), 40–47 (2011). Over 14,000 tons of silver were borrowed from the U.S. Treasury to make magnet coils for the calutron electromagnetic isotope separators at Oak Ridge. This article, a semi-popular version of Ref. 24 of MP-2, relates the history of this aspect of the Project. (E)

29. “The Feed Materials Program of the Manhattan Project: A foundational component of the nuclear weapons complex,” B. C. Reed, Phys. Perspect. 16(4), 461–479 (2014). The Feed Materials program of the Manhattan Project was responsible for acquiring uranium-bearing raw materials and processing them into forms suitable for use in uranium-enrichment and plutonium-production facilities. By January 1, 1947, this program had acquired just over 10,000 tons of uranium oxides (nearly 8700 tons of uranium) from sources in the Belgian Congo, Canada, the United States, and Europe at a cost of just over $90 million. This paper examines this program and how it became a core component of the postwar nuclear weapons complex. (E)

30. “Why 159°: A story about the dropping of the Hiroshima atom bomb,” S. Prunty, Phys. Scr. 90, 048001 (2015). After releasing the Little Boy bomb from the Enola Gay, pilot Paul Tibbets executed an escape maneuver involving a 159° turn in order to maximize the distance of the aircraft from the detonation and minimize the area of the aircraft exposed to the expanding shock wave. This paper uses basic geometry and kinematics to analyze the physics of this maneuver. (I)

31. “Kilowatts to kilotons: Wartime electricity use at Oak Ridge,” B. C. Reed, Hist. Phys. Newsletter XII(6), 5–6 (2015). It is not uncommon to read that during the war Oak Ridge was consuming about one-seventh of the electricity being produced in the United States. This article analyzes this claim, which originated with Manhattan District engineer Kenneth Nichols (Ref. 80 of MP-1). The one-seventh figure likely pertained to Tennessee Valley Authority generating capacity, not the national generating capacity. (E)

B. Technical and historical works

32. “Characterization of the World’s First Nuclear Explosion, the Trinity Test, as a Source of Public Radiation Exposure,” T. E. Widner and S. M. Flack, Health Phys. 98(3), 480–497 (2010). This paper discusses measurements of radioactivity conducted in the area around the Trinity site in the hours following the detonation. The test was a challenge for health physicists, and political pressure to conduct the test led to its being carried out in sub-optimal weather conditions. In many cases, monitoring instruments were unsuited for measuring contamination. The authors conclude that prior examinations of Trinity fallout did not address internal doses due to intake from contaminated air, food, and water, and that incomplete data prevents the test from being put into perspective as a source of public radiation exposure. (I)

33. “A memorandum that changed the world,” J. Bernstein, Am. J. Phys. 79(5), 440–446 (2011). Bernstein analyzes the physics underlying the famous Frisch-Peierls memorandum of early 1940, which stimulated British interest in the possibility of nuclear weapons. While the memo was garbled in places and the details of some of Frisch and Peierls’s assumptions led to their underestimating the critical mass of U-235, they clearly possessed a substantially sound understanding of fission-bomb physics, a full 18 months before Arthur Compton reported to Vannevar Bush on the feasibility of bombs in November, 1941 (Ref. 31, MP-2). (I)

34. “Fission fizzes: Estimating the yield of a pre-detonated nuclear weapon,” B. C. Reed, Am. J. Phys. 79(7), 769–773 (2011). This paper uses the pre-detonation-probability model of Ref. 34 of MP-2 to develop an undergraduate-level model for estimating the probability of achieving a given fraction of the design yield of a fission weapon if the chain reaction begins between the time that “first criticality” is achieved and when the core is fully assembled. (A)
35. “Simple calculation of the critical mass for highly enriched uranium and plutonium-239,” C. F. Chyba and C. R. Milne, Am. J. Phys. 82(10), 977–979 (2014). This brief paper presents an algebra-based approach to estimating critical masses; its goal is to give policy and arms-control audiences a sense of the magnitudes involved. (A)

36. “A zero-knowledge protocol for nuclear warhead verification,” A. Glaser, B. Barak, and R. J. Goldston, Nature 501(7506), 497–502 (2014). One of the vexing issues facing arms-control negotiations aimed at addressing individual warheads as opposed to delivery systems is that an X-ray or radiological scan of a warhead could reveal design information. The authors describe a system wherein a neutron detector could be “preloaded” with a radiograph negative of the design of a warhead and a null signal returned if the warhead is of the purported design. (A)

37. “Note on the minimum critical mass for a tamped fission bomb core,” B. C. Reed, Am. J. Phys. 83(11), 969–971 (2015). This paper gives a brief analysis of how to compute the minimum possible critical mass for a non-implosion fission bomb incorporating a tamper with a given neutron transport mean free path. (A)

38. “Seaborg’s plutonium? A case study in nuclear forensics,” E. B. Norman, K. J. Thomas, and K. E. Telhami, Am. J. Phys. 83(10), 843–845 (2015). In September 1942, Glenn Seaborg’s research group at the University of Chicago’s Metallurgical Laboratory isolated the first weighable sample of plutonium oxide: a 2.7-μg speck of the new element. The sample was discovered during a 2008 inventory of a hazardous material storage facility at Berkeley. In this paper, the authors report passive x-ray and gamma-ray spectroscopy of this sample, concluding that it contains 2.0 ± 0.3 micrograms of Pu-239 and is almost certainly the historical 1942 sample. (A)

39. “On the belated discovery of nuclear fission,” J. M. Pearson, Phys. Today 68(6), 40–45 (2015). This article summarizes the missteps, misinterpretations, and oversights that delayed the discovery of fission, which the author argues could have occurred as early as 1935. A comment on this article by Ruth Sime, author of a biography of Lise Meitner (Ref. 79 of MP-1), appears in Phys. Today 68(10), 10–11 (2015) along with a response from Pearson. (I)

40. “Measurements of extinct fission products in nuclear bomb debris: Determination of the yield of the Trinity test 70 years later,” S. K. Hanson, A. D. Pollington, C. R. Waidmann, W. S. Kinman, A. M. Wende, J. L. Miller, J. A. Berger, W. J. Oldham, and H. D. Selby, Proc. Natl. Acad. Sci. 113(29), 8104–8108 (2016). This paper describes an approach to measuring yields of nuclear explosions based on measurements of ratios of molybdenum isotopes created by the fission products of such explosions in combination with the amount of plutonium in explosion debris. When applied to the Trinity test, the method indicates an explosive yield of 22.1 ± 2.7 kilotons, in good agreement with a Department of Energy published estimate of 21 kilotons (Ref. 78). (A)

C. Biographical and autobiographical works

41. Reflections of a Nuclear Weaponeer, F. H. Shelton (Shelton Enterprise, Colorado Springs, 1988). Frank Shelton (1924–2014) joined the Sandia Corporation in 1952 to work on analysis of weapons effects, and subsequently spent his entire career in the field of nuclear weapons. Over his career, he witnessed 65 atmospheric nuclear explosions. This massive (>700 pages), extensively illustrated autobiography is a trove of information on the Manhattan Project and Operations Crossroads, Sandstone, Greenhouse, Ivy, Castle, Redwing, Plumbbob, and Hardtack. (I)

42. The First Nuclear Era: The Life and Times of a Technological Fixer, A. M. Weinberg (American Institute of Physics, New York, 1994). Alvin Weinberg joined Enrico Fermi’s reactor development team at the Metallurgical Laboratory of the University of Chicago in the fall of 1941 after completing his doctorate in biophysics at that institution. In 1945, he moved to Oak Ridge, where he became deeply involved with the development of numerous types of reactors and served for a time as the Director of Oak Ridge National Laboratory. The first few chapters of this autobiography cover material relevant to the Manhattan Project. (E)

43. Judging Edward Teller: A Closer Look at One of the Most Influential Scientists of the Twentieth Century, I. Hargittai (Prometheus Books, Amherst, NY, 2010). This survey of Teller’s life and work considers his life as a series of three exiles: from his native Hungary to Germany to study; from Germany to the United States in the 1930s; and from much of the physics community following his testimony against Robert Oppenheimer at the latter’s 1954 security-clearance hearing. Chapter 6 gives a detailed analysis of no less than five versions of the development of the H-bomb offered by Teller between 1955 and 2001. See also Ref. 85. (E)

44. Heisenberg in the Atomic Age: Science in the Public Sphere, C. Carson (German Historical Institute, Washington, DC, and Cambridge U. P., New York, 2010). This work analyzes the place of rationality in public life through studies of Werner Heisenberg’s work in re-shaping science in the West German “public sphere” following the war, with “public sphere” defined as a forum of interpersonal communication governed by the rules of reasonable dialogue. For physics-oriented readers, the most interesting parts of this work are Chapters 12–14, where Carson examines the postwar de-Nazification process and the construction and evolution of Heisenberg’s postwar statements on German fission research during the war; see Ref. 103 of MP-2. (E)

45. My True Course: Dutch Van Kirk, Northumberland to Hiroshima, S. S. Dietz (Red Gremlin Press LLC, Lawrenceville, Georgia, 2012). Authorized biography of Theodore “Dutch” Van Kirk, the Navigator of the Enola Gay for the Hiroshima bombing mission. Until his passing in 2014, Van Kirk was the last surviving member of the two atomic bombardment crews. (E)

46. Oppenheimer: A Life inside the Center, R. Monk (Doubleday, New York, 2012). This book is the American edition of a work originally published in Britain under the title Inside the Center: The Life of J. Robert Oppenheimer. Monk concentrates heavily on Oppenheimer’s personality and his philosophical, literary, and political interests. This book is interesting and thoughtful but contains little original research, relying heavily on Bird and Sherwin’s American Prometheus (Ref. 64 of MP-1) (E)
47. Keeper of the Nuclear Conscience: The Life and Work of Joseph Rotblat, A. Brown (Oxford U. P., Oxford, 2012). Polish-born physicist Joseph (originally Józef) Rotblat was one of the first experimenters to measure the number of secondary neutrons liberated in the fission of uranium. Rotblat joined the British Mission to Los Alamos, the only scientist to do so without becoming either a British or an American citizen, and left the project ostensibly for moral reasons when it became clear that Germany had no meaningful atomic project. In postwar years, Rotblat vigorously promoted nuclear arms control, and was one of the founding members of the Pugwash movement. Brown has also written an excellent biography of James Chadwick (Ref. 75 of MP-1). See also Ref. 59. (E)

48. Genius in the Shadows: A Biography of Leo Szilard, the Man behind the Bomb, W. Lanouette with B. Silard (Skyhorse Publishing, New York, 2013). This is a revised edition of Ref. 83 of MP-1, incorporating information from events that have transpired and documents which have become available since the original 1992 publication. (E)

49. Half-Life: The Divided Life of Bruno Pontecorvo, Physicist or Spy, F. Close (Basic Books, New York, 2015). Bruno Pontecorvo is now considered one of the founders of neutrino theory. A student of Enrico Fermi, Pontecorvo, a lifelong communist, worked on reactor development in Canada during World War II. In 1949, he moved to England to take up a position at the new British Atomic Energy Research Establishment Laboratory, and in mid-1950 defected to the Soviet Union. Pontecorvo’s seminal ideas in the area of neutrino physics were published in classified reports or Russian journals and so received little exposure in the West. This well-written book examines Pontecorvo’s life and career. Close spends many pages discussing whether Pontecorvo was a spy or not, but never resolves the issue. (I)

50. Emperor Hirohito and the Pacific War, N. Kawamura (University of Washington Press, Seattle, 2015). This biography presents a sympathetic view of Hirohito, who ascended to the throne at a young age and held pacifist, Western-oriented views but who by tradition exercised little direct control over the government and military. The author describes how a succession of weak, divided Japanese governments through the 1930’s failed to control insubordinate ultranationalist elements in the military, especially the army, which instigated increasingly aggressive actions in China, Russia, and Southeast Asia that led, to Hirohito’s disappointment, war with the United States and Britain. Chapter 6 presents a detailed analysis of discussions within the Japanese government that led to the decision to surrender. (E)

51. “Dropping the atomic bomb on Nagasaki,” F. L. Ashworth, Proc. U. S. Naval Inst. 84(1/659), 12–17 (1958). Capt. Frederick Ashworth was recruited to the Manhattan Project in late 1944, assigned to coordinate testing of non-nuclear components of the new atomic bombs. He served as weaponer aboard Bockscar for the trouble-plagued mission to Nagasaki. This brief article gives a memoir of his experiences with the Project and the mission. (E)

52. “Fifty years up and down a strenuous and scenic trail,” E. Segrè, Ann. Rev. Nucl. Part. Sci. 31, 1–18 (1981). This paper is a memoir by Emilio Segrè, who began his career as a student of Enrico Fermi and was involved in the discoveries of neutron-induced radioactivity and the efficacy of thermalized neutrons in inducing such reactions. During the Manhattan Project, he played a pivotal role in the discovery of the spontaneous fission characteristics of reactor-bred plutonium, a discovery which led to the development of the implosion bomb. In 1959, he shared the Nobel Prize for Physics with Owen Chamberlain for their discovery of the antiproton. (E)

53. “Ike and Hiroshima: Did he oppose it,” B. Bernstein, J. Strategic Stud. 10(3), 377–389 (1987). In various post-war memoirs, Dwight Eisenhower claimed that he told Secretary of War Henry Stimson that it was not necessary to drop atomic bombs on Japan. Through a study of diaries, contemporary documents, and memoirs of various participants, Bernstein, a noted historian of the bombings, shows that there is no evidence to support Eisenhower’s claim that he opposed the bombings in 1945. (E)

54. “J. Robert Oppenheimer (1904–1967),’’ in Biographical Connections: Albert Einstein, with profiles of Isaac Newton and J. Robert Oppenheimer, N. Pasachoff (World Book, Chicago, 2007). This volume is one of a series of biographies written for high-school students. Each volume features a biography of a central figure, flanked by briefer profiles of individuals whose work connected to that of the central figure. This profile of Oppenheimer runs to about 25 pages and provides a quick-read coverage of his life with references to fuller treatments. (E)

55. “The other atomic bomb commander: Colonel Cliff Heflin and his ‘Special’ 216th AAF Base Unit,” D. F. Dvorak, Air Power History, December 2012, pp. 14–27. The B-29 crews that dropped the atomic bombs on Hiroshima and Nagasaki trained at Wendover Army Air Force Base in Utah, also known as Kingman, Site K, and W-47. In late 1944, Col. Cliff Heflin, a veteran of special operations missions in Europe, was appointed base commander at Wendover. Heflin was instrumental in seeing to myriad logistical details of drop-test training operations and transport of equipment, bomb components, and crews to the Pacific. This article, written by Heflin’s son-in-law, describes his Air Force career. (E)


57. “The politics of forgetting: Otto Hahn and the German nuclear-fission project in World War II,” R. L. Sime, Phys. Perspect. 14(1), 59–94 (2012). This companion paper to Refs. 66 and 67 of MP-2 explores how Hahn mobilized the work of his institute toward military-related research at the outbreak of World War II and how this work contrasted with his postwar representation that his wartime activity had been openly published pure research. (E)

D. Foreign wartime programs, allied intelligence, and the use of the bombs

60. Japan’s Secret War, R. K. Wilcox (Wm. Morrow & Co., New York, 1985). This book surveys Japanese research into atomic energy during the war, concentrating on the leading individuals involved. Wilcox carried out extensive archival research with then-recently declassified files, but readers should be aware that this book suffers from his desire to inflate the story into more than it was; for example, he opens with the outlandish claim that the Japanese tested their own atomic bomb on August 12, 1945. Wilcox’s own text makes clear that the Japanese program was underfunded, understaffed, uncoordinated, and apparently of low priority to policy makers, conclusions amply reinforced by later scholarship (MP-2, Refs. 79 and 84–87). (E)

61. The Bomb in the Basement: How Israel Went Nuclear and What It Means for the World, M. Karpin (Simon and Schuster, New York, 2006). Israel is generally regarded as having acquired nuclear weapons in the 1960’s, but has never declared itself as a nuclear power and retains a policy of official ambiguity on the issue. This book, prepared by an Israeli journalist, documents the establishment and growth of that country’s nuclear program. Karpin’s description of some of the relevant physics is muddled in places, but he does a compelling job of setting the story against East-West cold-war politics, European involvement, a succession of wars between Israel and its Arab neighbors, and internal Israeli politics. (E)

62. “The U. S. Army, unconditional surrender, and the Potsdam Declaration,” B. L. Villa, J. Am. Hist. 63(1), 66–92 (1976). This paper explores the evolution of the meaning of the Allied policy of “unconditional surrender,” the roles played by various Army and State Department individuals and committees involved in developing and interpreting the policy, and how the ferocity of Japanese resistance on Okinawa impeded efforts to attenuate the policy to make it more acceptable to the Japanese. (E)

63. “Casualty projections for the U. S. invasion of Japan, 1945–1946: Planning and Policy Implications,” D. M. Giangreco, J. Mil. Hist. 61, 521–582 (1997). This paper reviews the history of American military casualty projections from the Revolutionary War up to World War II. As regards projections for the two-part invasion of Japan scheduled for late 1945 and the spring of 1946, some Army and War Department analysts projected manpower planning based on sustaining an average of 100,000 casualties per month from November 1945 through the fall of 1946. (E)

64. “Flawed nuclear physics and atomic intelligence in the campaign to deny Norwegian heavy water to Germany, 1942–1944,” H. C. Børreson, Phys. Perspect. 14(4), 471–497 (2012). Between November, 1942, and February, 1944, three bombing/commando raids and the sinking of a ferry in Norway were carried out to deny heavy water to Germany, at a cost of 80 lives. The author argues that since Germany had largely given up on the idea of developing nuclear weapons by 1942, these actions were a pointless consequence of excessive secrecy which prevented decision-makers being informed of relevant intelligence. (E)

65. “Confronting the Bomb: Pakistani and Indian scientists speak out,” edited by P. Hoodbhoy (Oxford U. P., Karachi, Pakistan, 2013). This volume is a collection of 17 essays on the Indian and Pakistani nuclear programs. The contributions cover issues such as the history of the programs, the roles played by a few influential scientists, proliferation implications, and the risks and consequences of a possible nuclear war between these two countries. (E)

66. “Uranium from German nuclear power projects of the 1940s–A nuclear forensic investigation,” K. Mayer et al., Angew. Chem. Int. Ed. 54(45), 13452–13456 (2015). The authors of this paper analyzed three pieces of uranium metal used in various German reactor experiments with various mass-spectroscopic techniques. They conclude that all of the uranium was mined in the Czech Republic, and that the uranium was not exposed to any major neutron fluence. Production of two pieces, metal cubes used in Werner Heisenberg’s reactor experiments, can be dated to late 1943/early 1944. (A)

E. Technical papers of historical interest

67. “Production of neutrons in uranium bombarded by neutrons,” H. L. Anderson, E. Fermi, and H. B. Hanstein, Phys. Rev. 55(8), 797–798 (1939). One of the crucial physical parameters in determining whether a chain reaction is possible is the number of neutrons liberated when a nucleus fissions. This paper and Ref. 68 were both published in the April 15, 1939, edition of the Physical Review. The authors report “about two” neutrons emitted by fissioning uranium nuclei per thermal neutron captured. See also Ref. 122 of MP-1. (A)

68. “Instantaneous emission of fast neutrons in the interaction of slow neutrons with uranium,” L. Szilard and W. H. Zinn, Phys. Rev. 55(8), 799–800 (1939). As with Ref. 67, these authors reported “about two” neutrons emitted per fission of uranium nuclei bombarded by thermal neutrons. In a follow-up paper published a few months later [Phys. Rev. 56(7), 619–624 (1939)], Zinn and Szilard present a more detailed analysis and reported a refined value of about 2.3 neutrons per fission. (A)

69. “Liberation of neutrons in the nuclear explosion of uranium irradiated by thermal neutrons,” T. Hagiwara, Rev. Phys. Chem. Jpn. 13(3), 145–150 (1939). In this paper published in Japan in late 1939, the average number of
neutrons per fission is reported as 2.6, a value very close to the currently accepted average number. (A)

F. Postwar developments

The legacies of the Manhattan Project include nuclear arms buildups, proliferation, near-catastrophic accidents with nuclear weapons, and revelations of deliberate exposure of military personnel and civilians to radioactivity. This section cites sources on all of these issues. Perhaps the most contentious legacy, however, is the continuing debate in historical circles over whether or not it was necessary to drop atomic bombs on Japan and the morality of doing so. The literature on this issue is vast, and the sources cited here have been selected to give a broad coverage of various viewpoints; this issue will likely never be fully settled [Refs. 75–77, 86, and 88].

70. Bombs at Bikini: The Official Report of Operation Crossroads, W. A. Shurcliff (Wm. H. Wise, New York, 1947). The joint Army-Navy Operation Crossroads was the first postwar nuclear test, and was held at Bikini atoll in the Pacific in the summer of 1946. Two Fat Man bombs were detonated, one air-dropped and one underwater; a number of vessels and people were contaminated by fallout. Glenn Seaborg called the operation “the world’s first nuclear disaster.” This volume is the official government report on the operation, and gives extensive detail on the preparations for and execution of the tests. Available online at: http://archive.org/download/bombsatbikinioff00unit/bombsatbikinioff00unit.pdf. (E)

71. The Advisors: Oppenheimer, Teller, and the Superbomb, H. F. York (Freeman, San Francisco, 1976). Herbert York worked on uranium isotope enrichment under Ernest Lawrence during World War II, and later, in his roles as the first director of both the Lawrence Livermore Laboratory and Defense Research and Engineering, became deeply involved in the debates which surrounded the development of the hydrogen bomb. York examines the physics, engineering, personalities, and political agendas involved, concentrating on Robert Oppenheimer and Edward Teller. See also Ref. 85. (E)

72. The Dragon’s Tail: Radiation Safety in the Manhattan Project, 1942–1946, B. Hacker (University of California, 1987). This book is the first volume of a two-volume work commissioned by the Department of Energy’s Nevada Operations Office in 1977 to document the history of radiation safety during the era of nuclear testing, work undertaken in response to litigation arising from the effects of such tests. This volume explores the early history of radiological safety following the discovery of X-rays through to the work of the Manhattan Project’s Health Division, including the Trinity and Crossroads tests (Ref. 70). Online reviews of Volume 2, Elements of Controversy: The Atomic Energy Commission and Radiation Safety in Nuclear Weapons Testing, 1947–1974, indicate that some damning evidence was edited out by the Department of energy without the author’s knowledge. See also Ref. 32. (E)

73. The Plutonium Files: America’s Secret Medical Experiments in the Cold War, E. Welsome (Dial Press, New York, 1999). Between April 1945 and July 1947, eighteen men, women, and children were injected with plutonium as part of a study to determine the effects of that element on human beings; the patients were not informed of what they were being given. The Atomic Energy Commission subsequently attempted to cover up these experiments, even while it authorized others which subjected thousands of civilians and military personnel to injections of and exposure to radionuclides. Welsome chronicles this horrific history, which began to come to widespread recognition only in the 1990’s. Following the report of the Advisory Committee on Human Radiation Experiments in early 1994, President Bill Clinton issued a public apology to the victims. See also Refs. 74 and 82. (E)

74. The Woman Who Knew Too Much: Alice Stewart and the Secrets of Radiation, G. Greene (University of Michigan Press, Ann Arbor, 2001). This book relates the story of the life and career of Alice Stewart (1906–2002), a British physician and epidemiologist who in the 1950’s established that exposure to a single pre-natal X-ray doubled a child’s chance of subsequently developing leukemia. In the 1970’s, Stewart became involved with a study of the effects of low-level radiation on workers at the Hanford site, finding evidence of increased cancers for exposures to radioactivity at even one-tenth of the dose considered safe. As Greene relates, these findings attracted harsh criticism and stonewalling from the Department of Energy, which had initially funded the study. Whether or not a threshold for radiation damage exists is still debated, but Stewart’s story is a sobering reminder of how powerful interests can work to discredit scientists who challenge orthodoxy. Stewart is now regarded as a pioneering radiation epidemiologist. (E)

75. Prompt and Utter Destruction: Truman and the Use of Atomic Bombs Against Japan, J. S. Walker (University of North Carolina Press, Chapel Hill, NC, 1997). This brief volume reviews the political and military situation that faced Harry Truman when he assumed the Presidency. Truman sought to end the war with minimal casualties, but the available non-atomic options aside from an invasion (continue bombing and blockading, wait for Soviet entry into the war, mitigate the terms of unconditional surrender) held various risks and by no means guaranteed success either alone or in combination. In response to the question of whether use of the bombs were necessary, Walker answers “yes … and no” on the basis that they brought the war to a quick end but that it might well have ended before the planned November 1, 1945 invasion of Kyushu. He attributes Truman’s decision to use the bombs to five considerations: to end the war as quickly as possible, to justify the expense of the Manhattan Project, to achieve diplomatic leverage over the Soviet Union, a lack of incentives to not use the bombs, and vengeance. (E)

76. Racing the Enemy: Stalin, Truman, and the Surrender of Japan, T. Hasegawa (Belknap Press, Cambridge, MA, 2005). This book considers the end of the war in the Pacific as a three-way Japanese-American-Soviet scenario with Stalin as a much more active manipulator than is often acknowledged. Hasegawa focuses on three sub-plots to the story: a “race” between Truman and Stalin to force Japan to surrender by use of the bomb and an invasion, respectively; the tangled relationship between Japan and the Soviet Union; and the conflict between war and peace factions within the Japanese
leadership. Hasegawa supports arguments of both traditionalist and revisionist historians, agreeing that Emperor Hirohito had not decided to surrender before Hiroshima (traditionalist viewpoint), but also positing that the bombings were not decisive in convincing the Japanese to surrender whereas the Soviet invasion of Manchuria was (revisionist). He also places blame on Emperor Hirohito for not accepting the terms of the Potsdam declaration earlier, which he feels would have avoided both the use of the bombs and the Soviet invasion. In his concluding chapter, Hasegawa explores a number of interesting counterfactual “roads-not-taken” scenarios for the end of the war. (E)

77. Hiroshima in History: The Myths of Revisionism, edited by R. J. Maddox (University of Missouri Press, Columbia, MO, 2007). This book comprises a collection of essays which examine the claims of “revisionist” historians that it was not necessary to drop nuclear weapons on Hiroshima and Nagasaki to help end the war. Various authors argue that such claims are based on selective or out-of-context readings of documents, temporal shuffling of documents and statements, after-the-fact assessments, and changing postwar statements of political and military figures. One essay deals with the 1995 Enola Gay controversy at the National Air and Space Museum (Ref. 44 of MP-1). (E)

78. United States Nuclear Tests July 1945 through September 1992 (United States Department of Energy, Nevada Operations Office, 2000). This 162-page booklet lists both chronologically and alphabetically all 1054 nuclear tests conducted by the United States, with information on time and location of detonation, type of detonation (underground, airdrop, etc.), and estimated yield. The Hiroshima and Nagasaki explosions are not included as they were not considered to be tests. Available from the Department of Energy’s Office of Scientific and Technical Information (OSTI) at https://www.osti.gov/opennet/manhattan-project-history/publications/DOENuclearTests.pdf (E)

79. Unmaking the Bomb: A Fissile Material Approach to Nuclear Disarmament and Nonproliferation, H. A. Feiveson, A. Glaser, Z. Mian, and F. N. von Hippel (The MIT Press, Cambridge, MA, 2014). The authors of this book are concerned with the danger posed to civilization by the existence, continued production, and use of fissile materials, primarily plutonium and highly enriched uranium. This work describes the history, production, current stockpiles, and uses of fissile materials in reactors and weapons, and proposes a set of policies aimed at drastically reducing the quantities of these materials and the number of locations around the world where they are stored. (I)


81. Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety, E. Schlosser (The Penguin Press, New York, 2013). This work describes the growth of the postwar nuclear weapons complex, with particular emphasis on the culture of the Strategic Air Command and how bureaucratic inertia, inter-service rivalries, and the interests of weapons laboratories conspired to frustrate individuals who advocated for safer nuclear weapons and rational targeting policies. Schlosser describes a number of accidents where nuclear detonations were sometimes only narrowly avoided. “Damascus” refers to the accidental explosion of a Titan II missile inside a silo near Damascus, Arkansas, in September, 1980. One Air Force serviceman died due to injuries; toxic vapors escaped the silo; and the missile’s payload, a W-53 warhead with a 9-megaton yield, landed a couple hundred yards away but did not detonate. (E)

82. Life Atomic: A History of Radioisotopes in Science and Medicine, A. N. H. Creager (University of Chicago Press, Chicago, 2013). After the war, the Manhattan Engineer District and later the Atomic Energy Commission authorized the sale, both domestically and internationally, of stable and radioactive isotopes for medical treatments and research in order to promote humanitarian uses of nuclear energy and American political influence. Creager analyzes the movement of radioisotopes through government facilities, laboratories, and clinics. Particularly interesting is her exploration of the shift in public perception of radioactive isotopes from being curative entities to being causes of cancer. (E)


84. Nuclear Iran, Jeremy Bernstein (Harvard U. P., Cambridge, 2014). This brief volume reviews the Iranian nuclear program to late 2013. (I)

85. Building the H Bomb: A Personal History, K. W. Ford (World Scientific, Singapore, 2015). Kenneth Ford was a graduate student of John Wheeler when Wheeler and Edward Teller courted him to work on the “super” bomb project at Los Alamos in mid-1950; the next year he transferred to “Project Matterhorn” back at Princeton University, where he became involved in programming punch-card computers and one of the first stored-program computers, the SEAC, to predict the behavior of the Teller-Ulam design for the “Ivy Mike” test of November, 1951. This volume is a personal memoir of Ford’s two-year involvement in the H-bomb project, and includes an excellent summary of the continuing debate over the question of who deserves priority for the Teller-Ulam radiation-implosion concept. Ford was asked to censor parts of the book by the Department of Energy; he refused and published it unexpurgated. (E)
86. Nuclear Energy and the Legacy of Harry S. Truman, edited by J. Samuel Walker (Truman State U. P., Kirksville, Missouri, 2016). There is probably no aspect of President Truman’s legacy of greater significance than his involvement with Hiroshima and Nagasaki and his postwar nuclear policies. Under Truman’s administration, the Atomic Energy Commission came into being, as did the Strategic Air Command, the Cold War, and the decision to develop thermonuclear weapons. This volume comprises essays derived from talks given at the Twelfth Truman Legacy Symposium, which was held in Key West, Florida, in 2014. Topics covered include the end of World War II, the origins of the nuclear arms race, the role of radioisotopes as political instruments of domestic and foreign policy, and politics surrounding the development of the first generation of research reactors. Essays describing political maneuverings within the Japanese government at the time of the bombings seriously discredit revisionist assessments that America used the bombs against an enemy that was on the verge of surrender (see in particular Ref. 34 of MP-1). See also Ref. 89. (E)

87. “The American people and the use of atomic bombs on Japan: The 1940s,” M. J. Yavenditti, Historian 36(2), 224–247 (1974). This paper explores responses to the bombings of Hiroshima and Nagasaki among various social, religious, political, and commentator groups and the reasons why such groups that did express opposition to the bombings failed to generate widespread public remorse in America. (E)

88. “Eclipsed by Hiroshima and Nagasaki”, B. J. Bernstein, Int. Secur. 15(4), 149–173 (1991). This paper examines consideration given to possible tactical use of nuclear weapons in World War II. In a July 30, 1945, memo to Army Chief of Staff Gen. George C. Marshall, Manhattan commander General Leslie Groves reviewed the likely availability of bombs in advance of the scheduled November 1 invasion of Japan and the effects that bombs would have on enemy troop concentrations. Following the bombings of Hiroshima and Nagasaki, Marshall felt that a third bomb might not have the psychological impact of the first two and began to think about reserving future bombs for supporting invasion operations. Bernstein contends that arguments to the effect that atomic bombs were used on Japan to intimidate the Soviet Union are flawed in that they would undoubtedly have been used even if the Soviet Union had not existed. (E)

89. “The Shock of the Atomic Bomb and Japan’s Decision to surrender–A Reconsideration,” S. Asada, Pacific Hist. Rev. 67(4), 477–512 (1998). In this paper, a Japanese historian examines the effects of the atomic bombs on the Japanese decision to surrender, based on an analysis of records of debates of the Japanese Supreme War Leadership Council. The Council was split between one faction which realized Japan’s situation to be hopeless, and another which wished to continue the war, with the result that vacillation in the weeks before the bombings delayed any serious consideration of surrender. Asada contends that the bombs had more shock effect on Japanese leaders than the Soviet declaration of war because the bombings were unexpected and struck the Japanese homeland directly. Asada further argues that by adopting a stance of postwar atomic victimization, the Japanese government and people were able to avoid having to address their nation’s role in the Pacific war. This paper is reprinted in Ref. 77. (E)

90. “Atomic John: A truck driver uncovers secrets about the first nuclear bombs,” D. Samuels, New Yorker LXXXIV(41), 50–63 (2008). This article profiles John Coster-Mullen, author of Atom Bombs: The Top Secret Inside Story of Little Boy and Fat Man (MP-2, Ref. 2). Samuels describes the remarkable story of Coster-Mullen’s decade-long quest to painstakingly reverse-engineer Little Boy and Fat Man. A key message of this article is the futility of trying to keep weapons information secret seven decades after the fact. (E)

91. “Recent Literature on Truman’s Atomic Bomb Decision: A Search for Middle Ground,” J. S. Walker, Diplomatic Hist. 29(2), 311–334 (2005). This essay summarizes the arguments of “traditionalist” historians who maintain that the use of atomic bombs against Japan was necessary to end the war and forestall a costly invasion versus the claims of “revisionists” that the bombs were intended more to intimidate the Soviets and that the Japanese were on the verge of surrender. Walker shows that members of both sides advance fallacious arguments based on selective evidence. He also reviews the work of a third group whose members attempt to chart a middle ground between these extremes. As Walker points out, arguments as to whether or not use of the bombs was necessary are perpetually inconclusive as the answers offered are so dependent on counterfactual analyses. (E)

92. “Some myths of World War II,” G. Weinberg, J. Mil. Hist. 75, 701–718 (2011). This article does not deal with the Manhattan Project per se but might be of interest to readers who seek to frame the Project within the larger context of World War II. The author discusses some of the myths that have built up around various battles, strategies, political calculations, and leaders involved with the war. (E)

G. Educational materials

93. Bomb: The Race to Build–and Steal–the World’s Most Dangerous Weapon, S. Sheinkin (Roaring Press, New York, 2012). This award-winning book is aimed at middle-school children (grades five and up), and dramatically and accurately tells the story of the discovery of fission, the building of the bombs, and the espionage efforts of Harry Gold, Klaus Fuchs, and Theodore Hall. An excellent introduction to the Manhattan Project for young readers. (E)

94. “The Manhattan Project–A part of physics history,” A.-M. Mårtensson-Pendril, Phys. Ed. 41(6) 493–501 (2006). This article describes a role-playing exercise developed for Swedish education students wherein each student researches the life and career of a physicist involved with the Manhattan project and then role-plays that individual before the instructor and other students. This paper includes a number of quotes from Manhattan veterans reflecting on the project and their reactions to being involved in it. (E)

95. “Teaching the Manhattan Project: Bringing literacy in civic science to the chemistry class,” E. Schibuk, Sci. Teach. 82(7), 27–33 (2015). This article, in a journal for high-school science teachers, describes a unit developed
for an introductory nuclear chemistry class that takes 4–6 weeks to complete and links the material to Next Generation Science Standards. Topics include radioactivity, nuclear and chain reactions, fission, the scale of the Manhattan Project, and the bombings of Hiroshima and Nagasaki. See also Ref. 96. (E)

96. https://www.aip.org/history-programs/physics-history/african-americans-and-manhattan-project; “African Americans and the Manhattan Project,” The American Institute of Physics, Center for History of Physics. Lesson plan for high-school teachers on African-Americans and the Manhattan Project that is cross-referenced to Common Core standards. (E)

97. http://digital.library.unlv.edu/ntsohp; “Nevada Test Site Oral History Project,” University of Nevada, Las Vegas. Between 1951 and 1992, 1021 nuclear detonations took place at the Nevada Test Site. This site makes available transcripts and videos of interviews with scientists, engineers, government officials, military personnel, and corporate officials who were involved with the testing program as well as with native Americans, activists, protestors, and local families who were affected by fallout. (E)

III. VIDEOS AND WEBSITES


100. http://manhattanprojectvoices.org/oral-histories/hans-bethe-interview; the interview (audio and transcript) of Hans Bethe by Richard Rhodes. Bethe discusses the role of espionage and Soviet spying during the Manhattan Project. This interview is one of many available at the Atomic Heritage Foundation’s “Voices of the Manhattan Project” website, the following reference. (E)


102. https://www.osti.gov/opennet/smyth_tolman_reports.jsp; Reports of the Declassification Committee. Just after the end of the war, General Groves asked physicist Richard Tolman to chair a Declassification Committee to develop declassification guidelines for Manhattan Project-related information. Over the course of three meetings held during late 1945, the committee consulted with scientists, contractors, and government patent lawyers to develop such a system. Topics addressed included information on the fundamental physics of materials, isotopes, instrumentation, and chemical and industrial processes. While the committee attempted to develop a system that was adaptable to future developments, their work was rather ad-hoc, and internal contradictions in the nuclear classification system remain to this day. (I)

103. https://www.youtube.com/watch?v=foPljAaG8sl; Film footage of a house being blown apart and fake trees being bent by a nuclear explosion are now practically an element of popular culture. These scenes appeared in a 1954 film, “Let’s Face It.” This 13 min video shows the story behind this Nevada bomb test. A National Archives link can be found at https://archive.org/details/LetsFaceIt_966 (E)

104. https://www.youtube.com/watch?v=XNmtTkMbTaw; The 1955 color documentary “Operation CUE” shows an atomic test with dummies in simulated houses along with the blast effects on power sub-stations, radio towers, and liquid gas tanks. A National Archives link can be found at https://archive.org/details/OperationCUE (E)

105. “Secret City: The Oak Ridge Story. The War Years” (HP Video, 2005). This DVD relates the story of the development of the Clinton Engineer Works at Oak Ridge, particularly the Y-12 electromagnetic and K-25 thermal diffusion plants and the X-10 graphite reactor. Rare color footage of construction activities is interspersed with black-and-white images of community and social life, interviews with people who worked there, and historians and preservationists. (E)

106. http://www.youtube.com/watch?v=HWnm4N8Wnmk&feature=channel_video_title; A 9-min video of some of the earliest known footage of construction at Oak Ridge. In particular, the video shows some early construction activity at the Y-12 electromagnetic separation plant. (E)

107. http://cdm16107.contentdm.oclc.org: Oak Ridge Public Library Digital Collections. Websites containing photographs and records pertaining to Oak Ridge can be accessed through the Oak Ridge Public Library Digital Collections. Material includes photos taken by official Manhattan Project photographer Ed Westcott (Ref. 13), as well as scenes of everyday life at Oak Ridge during the war. (E)

108. Various fission and fusion weapons were tested at Bikini Atoll. This website shows where each explosion was detonated: http://wikimapia.org/?lang=en&lat=11.701855&lon=165.285857&r=18&m=b&search=Remains%20of%20Castle%20Bravo%20causeway. Bikini is a large atoll; be sure to zoom in and out and use your mouse to pan around. (E)

109. https://www.osti.gov/opennet/manhattan_district.jsp; The Manhattan District History (MDH) is an extensive multimedia history of the Project that was prepared after the war by Gavin Hadden, an aide to General Groves. The MDH was previously available only on microfilm from the National Archives, but in late 2013, the Department of Energy began posting it online. (I)

110. https://www.osti.gov/opennet/hearing.jsp; In October 2014, the Department of Energy released previously classified material from transcripts of Robert Oppenheimer’s 1954 security hearing. This material is part of the DoE’s Manhattan Project Resources site. (I)

111. https://www.flickr.com/photos/losalamosnatlab/sets/72157624881000675/; Over 500 photographs and images of historic documents are available at Los Alamos Laboratory. (E)

112. https://www.aip.org/history/ead/20000092.html; The Niels Bohr Library and Archives of the American
Institute of Physics have posted online the complete papers of Samuel Goudsmit, including those related to the Alsos mission (Refs. 99 and 102 of MP-1). (A).

http://nuclearsecrecy.com/blog; Historian of science Alex Wellerstein (Ref. 22 of MP-2) maintains a website on nuclear secrecy which contains a number of documents, photos, and resources for teachers and students. Of particular note is his “Nukemap” program, which allows users to get an idea of the effects of detonating a nuclear weapon of specified yield at a given location. (E).

www.trinityremembered.com; Photographs, documents, maps, videos, transcripts of personal reminiscences; bibliographies of printed and online sources regarding the Trinity test. This site is a member of the Nuclear Pathways Project, funded by the National Science Foundation’s National Science Digital Library program. Nuclear Pathway’s goal is to make information on historic and current nuclear issues more accessible and comprehensible to the public, educators, and students from middle school through graduate programs. (I)

http://www.alternatewars.com/Bomb_Loading/Bomb_Guide.htm; Ryan Crierie has assembled a number of captioned photographs of the final preparations and loading of the Little Boy and Fat Man bombs at Tinian under the title “An Illustrated Guide to the Atomic Bombs.” (E)

http://foreignpolicy.com/2014/01/30/the-littlest-boy; The “Davy Crockett” B-54 Special Atomic Demolition Munition entered the United States’ arsenal in 1964. This compact tactical nuclear weapon (sub-kiloton) could be carried by an individual soldier who could be deployed on the ground, via parachute drop, or via scuba diving. This article describes this device, some of the missions intended for it, and the training received by Army personnel qualified to deploy it. (E)

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