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## PART II

# ATOMS FOR WAR AND PEACE, 1939-1974: THE SECOND TRADITION

### THE EINSTEIN LETTER AND ATOMS FOR WAR

In August 1939, on the eve of the Second World War, Albert Einstein, with the help of Hungarian emigré physicist Leo Szilard, wrote a letter to President Franklin D. Roosevelt, informing him that recent research showed that a nuclear chain reaction in a large mass of uranium could generate vast amounts of power. This could conceivably lead, Einstein wrote, to the construction of “extremely powerful bombs.” A single bomb, the physicist warned, potentially could destroy an entire seaport. Einstein called for government support of uranium research, darkly noting that Germany had stopped the sale of uranium and German physicists were engaged in uranium research.<sup>15</sup>

President Roosevelt responded cautiously but positively to the Einstein missive. He appointed the Advisory Committee on Uranium, headed by Lyman J. Briggs, director of the National Bureau of Standards. The committee recommended funding for isotope separation, involving the separation of uranium<sup>235</sup>—the isotope required for a chain reaction—from the more abundant uranium<sup>238</sup>, and chain reaction work. Funding was limited and research proceeded slowly, however, because of uncertainty whether an atomic bomb was even possible. In summer 1941 British physicists reported their belief that uranium research could lead to the production of a bomb in time to affect the outcome of the war. Vannevar Bush, director of the newly created Office of Scientific Research and Development, under whose authority the Uranium Committee had been subsumed, took this information to the White House and emphasized the continuing uncertainty involving a bomb. Realizing that German

research was ongoing, Roosevelt instructed Bush to move as quickly as possible on research and development. Following a year of furious activity, Bush reported to the President that atomic bombs possibly could be available by the first half of 1945. On December 28, 1942, Roosevelt authorized the construction of full-scale production plants with an initial expenditure of \$500 million.<sup>16</sup>

### THE MANHATTAN PROJECT

Security requirements suggested placing the atomic bomb project under the Army Corps of Engineers. For the project, the Army set up the Manhattan Engineer District commanded by Brigadier General Leslie R. Groves. The Manhattan Engineer District operated like a large construction company, but on a massive scale and with a sense of urgency until now unknown. Unique as well was the investment of hundreds of millions of dollars in unproven processes. By the end of the war, Groves and his staff expended approximately \$2.2 billion on production facilities, towns, and research laboratories scattered across the Nation. Secrecy and fear of a major accident dictated that the production facilities be located at remote sites. Two distinct paths were chosen to obtain a bomb.<sup>17</sup>

One involved isotope separation of uranium<sup>235</sup>. Groves located the production facilities for isotope separation at the Clinton Engineer Works, a ninety-square-mile parcel carved out of the Tennessee hills just west of Knoxville (the name Oak Ridge did not come into usage until after the war). Groves placed two methods into production: 1) gaseous diffusion, based on the principle that molecules of the lighter isotope, uranium<sup>235</sup>, would pass more readily through a porous barrier; and 2) electromagnetic, based on the principle that charged