NUCLEAR TECHNOLOGIES AND NUCLEAR COMMUNITIES:

A HISTORY OF HANFORD AND THE TRI-CITIES, 1943-1993

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PREFACE

This manuscript offers a narrative history of Hanford and the Tri-Cities. It presents an overview of the fifty years since the founding of the Hanford plant and the new town of Richland in 1943. As a collaboration between a historian of technology (Bruce Hevly) and a historian of western communities (John M. Findlay), the manuscript naturally naturally incorporates those two perspectives. Both of us are concerned with the cultural history of Hanford and the Tri-Cities, particularly as it can be understood within the contexts of modern U.S. civilization, the American West, and Washington state.

In our researching and writing during the last few years, we have been acutely aware of the intense current interest in Hanford, and of the new publications and ongoing investigations concerning its history that have stemmed from this interest. In fact, our success in studying Hanford and the Tri-Cities derives in large part from the efforts of others who have led the way in arriving at conclusions and, equally important, in making available sources that previously had been inaccessible. As our endnotes acknowledge, we owe a considerable debt to other researchers and writers. However, we have not had the same emphases and concerns as other investigators, and we view our study as a complement to other works.

When we began our study of Hanford in 1989, we noted some shortcomings in the extant historical literature pertaining to

Hanford. First, much had been written from the perspective of Washington, D.C. In the three-volume, official history of the Atomic Energy Commission, Hanford is treated largely as a distant, minor satellite in a solar system revolving around policy-makers in the nation's capital. Little thorough research and writing had been done concerning either the development of the site and its influence on surrounding communities, or the relationship between Hanford and Washington, D.C.

The scholarly neglect of Hanford was not replicated in the cases of Oak Ridge, Tennessee and Los Alamos, New Mexico. These atomic facilities had, like Hanford and Richland, also been created during World War Two, but they were apparently more attractive to scholars, perhaps because their research-and-development missions seemed more interesting, maybe even more glamorous. The Hanford site, unlike the others, was devoted to plutonium production. What went on there was an industrial story above all. Neglect of this distinguishing feature of the nature of the historical attention paid to the site was a second shortcoming in the historical literature. This industrial story was most clearly evident in the years after the Second World War, a fact that illuminated a third weakness in the historical attention paid to Hanford. Most students of the site had concentrated primarily on its role in the Manhattan Project. Few examined its development after 1945, even though its postwar expansion and its role as the primary source of fissionable materials for America's weapons program between 1946 and 1953 made it unique.

Since we have been researching and writing ourselves, a number of the gaps in Hanford's history have been filled in by other studies. On the Home Front: The Cold War Legacy of the Hanford Nuclear Site (1992), by Michele Stenehjem Gerber, has greatly increased our knowledge of Hanford during the period 1945-1964. The book also addresses developments in the Tri-Cities during the 1980s. Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal (1993), by Michael D'Antonio, narrates the developments of the later 1980s and early 1990s during which a number of investigators unearthed unsafe practices, both in Hanford's more distant past (mainly 1944-1964) and in more recent times (1985-1988). These books are just two titles out of an outpouring of recent and ongoing work on Hanford conducted by journalists, scholars, activists, and others. Researchers working on the Hanford Environmental Dose Reconstruction Project, on the Hanford Thyroid Disease Study, on various Hanford environmental restoration efforts, and on the lawsuits surrounding Hanford's impact on Northwest populations, are also contributing to the flood of information about Hanford.

Our study has benefited enormously from the existence of these many other efforts, and it has incorporated many of their data and conclusions. However, we submit that these other studies have limitations with which scholars must reckon. A number of the studies remain controversial and, we think, flawed. Furthermore, these other studies, like earlier efforts looking just at the period of the Second World War, tend only to cover certain eras of Hanford's history. On the Home Front, for

example, focuses particularly on the years prior to 1964 and does much less with succeeding years. Atomic Harvest, by contrast, primarily addresses the years 1985-1992.

The various existing studies tend to have one additional overriding thing in common. Almost every one of them represents a direct response to current concerns over the health effects of Hanford emissions. There are very good reasons why Hanford's health effects have grabbed center stage, and we do not wish to suggest that the situation should be otherwise. However, we do believe that, because of the overriding focus on emissions and public health, many key dimensions of the story of Hanford and the Tri-Cities--including dimensions which may have direct or indirect bearing upon the health effects issue--remain rather neglected. Because of the concern surrounding health effects, there has been a tendency to write a quite specialized history of Hanford before a more general view is in place.

Consequently, our goal has been to develop a narrative overview of Hanford and its social, political, and economic relationships to the surrounding metropolitan area, extending from the early 1940s through the early 1990s. We are concerned especially with surveying how technological, spatial, and cultural communities emerged, influenced each other, and experienced change as Hanford's fortunes waxed and waned over five decades. Our story certainly overlaps with that told by others, but it differs as well in its emphases and nature.

Like other writers, we review developments prior to 1945, but the bulk of our work concerns the era after 1945. In three

chapters we focus especially on the culture and technology of Hanford as a production facility between 1945 and 1964, and then in two more chapters consider how Hanford and the Tri-Cities responded to the loss of the plutonium-producing mission after 1964. We include a great deal of material on Richland, "The Atomic City of the West," and we also survey, more briefly, developments in Pasco and Kennewick. We are concerned to show how the Tri-Cities area was affected by nuclear technologies and by federal policies concerning Hanford. Our review of the politics behind Hanford entails a consideration of the local, state, and federal arenas of government, because decisions made at each of these levels had a bearing on the evolution of Hanford and the Tri-Cities. Rather than focus either on policy-makers in the nation's capital, or on events and people in the vicinity of Hanford, we try to portray the relationships between the two different places.

In the course of doing work on somewhat neglected topics, we have naturally undertaken research in a number of somewhat neglected collections of primary sources and secondary materials. These include manuscript collections in the National Archives system, in the Historian's Office of the Department of Energy, and at the University of Washington Library. We have also considered a wide variety of published materials, including technical publications and the mass media. Like other scholars, we have also made use of the DOE Public Reading Room in Richland.

While we feel that our research has been extensive, however, we do not claim to have consulted "all" the relevant documents,

or even all the "important" ones. Given the time and budgetary constraints under which this study has been prepared--and given the fact that recent U.S. history presents scholars with the problem of too many documents, and not too few--it was clear that we had to be selective in the sources we consulted, just as we were selective in the topics upon which we focused. Hanford's story is large and complex. No one monograph will capture it.

Furthermore, for us this study of Hanford remains a work in progress. We are pleased to provide the DOE with a manuscript that can be of use as people commemorate the fiftieth anniversary of Hanford and Richland. At the same time, we intend to continue our work on Hanford and the Tri-Cities--consulting more primary sources, benefiting from the continuing stream of publications on Hanford, gaining additional perspective on our interpretation, and writing more about the topic. We have already benefited from feedback on previous drafts of this manuscript by incorporating some of the suggestions of our readers.

* * *

In the course of our work we have received generous assistance from many quarters. Financial support from the DOE was extended through the office of Tom Bauman of the Richland Operations Office. The details of our cooperative agreement were arranged and managed by Marji Parker of the Richland Operations Office. Dennis Deford and Dr. Michele Stenehjem Gerber of the Westinghouse Hanford Company conversed with us about Hanford's history, and Terri Traub and the staff at the DOE Public Reading Room proved courteous and helpful in locating and copying

materials for us. Every one of these individuals offered us encouragement.

At DOE offices in Germantown, Maryland, Dr. Roger Anders, Archivist-Historian, and other members of the Historian's Office assisted us in locating materials pertinent to our study. Dr. Anders and Dr. Benjamin Franklin Cooling, Chief Historian, offered both constant encouragement and helpful comments on our draft chapters. We also benefited from readings of earlier drafts by Michele Stenehjem Gerber and by Dr. Ronald L. Kathren of Washington State University, Tri-Cities.

Regarding the staffs of the various branches of the National Archives that we visited, special thanks go to Dr. Sue Karren of the Pacific Northwest Region in Seattle and Dr. Charlie Reeves of the Southeast Region in East Point, Georgia. We similarly benefited from the staff, especially Karyl Winn, at the Manuscripts and University Archives, University of Washington Libraries.

Professors Jere Bacharach and Richard Johnson, past and present chairs of the History Department at the University of Washington, have supported our project in numerous ways, and Marge Healy oversaw its administration for the department and the University. The following students served as graduate research assistants: Jennifer Alexander, Sharon Boswell, John Eby, Glen Furnas, Lorraine McConaghy, Laura McKinley, Kathy Morse, Will Prust, Joe Roza, Robert Self, and Moran Tompkins. Their work was often tedious, but vital, as they inventoried unindexed materials

such as the trade journal Nucleonics, the Tri-City Herald, and Hanford-related materials on the University of Washington campus.

The following scholars offered us nuggets from their own research and thinking about Hanford: Fred Clagett, Stanley Goldberg, Dan Grossman, Tom Hankins, and Henry Matthews.

LIST OF ABBREVIATIONS USED IN TEXT AND ENDNOTES

47-51sec	1947-1951 U.S. Atomic Energy Commission Secretariat Files, National Archives, Washington, D.C. When consulted for the present manuscript, these papers were located at the DOE Historian's Office and Archives, Germantown, Maryland. Items from the collection are generally cited with box and folder numbers, as in 97:20.
51-58Sec	1951-1958 U.S. Atomic Energy Commission Secretariat Files, National Archives, Washington, D.C. When consulted for the present manuscript, these papers were located at the DOE Historian's Office and Archives, Germantown, Maryland. Items from the collection are generally cited with box and folder numbers, as in 97:20.
58-66Sec	1958-1966 U.S. Atomic Energy Commission Secretariat Files, DOE Historian's Office and Archives, Germantown, Maryland Items from the collection are generally cited with box and folder numbers, as in 97:20.
AEC	U.S. Atomic Energy Commission
CBN	Columbia Basin News
DOE	U.S. Department of Energy
EHC	Uncatalogued materials in the Energy History Collection, DOE Historian's Office and Archives, Germantown, Maryland
ERDA	U.S. Energy Research and Development Administration
FCP	Fred Clagett Papers, Accession 3543, Manuscripts and University Archives, University of Washington Libraries
FTM	"Col. F[ranklin].T. Matthias, Notes and Diary" [1942-1946] This microfiche document was consulted at PRR.
GE	General Electric
GenMan	General Manager Files, held within the DOE Archival Collections and consulted at the DOE Historian's Office and Archives, Germantown, Maryland
HEWMR	Hanford Engineer Works Monthly Report These reports were generally consulted in PRR.

HMJP — Henry M. Jackson Papers, Accession 3560, Manuscripts and University Archives, University of Washington Libraries
This collection has been subdivided by period, so that Jackson's first two senatorial terms, 1952-1963, for example, are covered mainly in Accession 3560-3. In the notes, this subdivision of the accession is given as HMJP-3. Items from the collection are generally cited with box and folder numbers, as in 97:20.

HWMR — Hanford Works Monthly Report
These reports were generally consulted in PRR.

JCAE — Joint Committee on Atomic Energy, U.S. Congress

JGT — J. Gordon Turnbull, Inc., and Graham, Anderson, Probst, and White, Inc. [authors of Master Plan for Richland, Washington, 1948]

JointCom — JCAE Materials, held within the DOE Archival Collections and consulted at the DOE Historian's Office and Archives, Germantown, Maryland

LP — David Lilienthal Papers, Record Group 236, National Archives, Washington, D.C.

MED-C — [Manhattan Engineering District], Correspondence 1943-1949, Record Group 326, Accession 68A588, National Archives Center, Southeast Region, East Point, Georgia

MEDPR — Manhattan Engineering District Project Records 1943-1947, Record Group 326, Accession 4NN-326-8505, National Archives Center, Southeast Region, East Point, Georgia

MRCF-ACC — Mail and Records Central Files, Office Services Branch, MED & CEW; Areas and Contractors Correspondence, Jan. 1947 to June 1948, Record Group 326, Accession 67A803, National Archives Center, Southeast Region, East Point, Georgia

MRCF-DF — Manhattan Engineer District (CEW), Mail and Records Central Files, War Department, Decimal Files 1943-1948, Record Group 326, Accession 66A1405, National Archives Center, Southeast Region, East Point, Georgia

NYT — New York Times

PAS — Public Administration Services, Inc.

P-I — Seattle Post-Intelligencer

Prod — AEC Division of Production materials, held within the DOE Archival Collections, consulted at the DOE Historian's Office and Archives, Germantown, Maryland

PRR — DOE Public Reading Room, Richland, Washington

RCC — Richland Community (or City) Council, Minutes and Records
This was the advisory council consulted by GE and the AEC in the governance of Richland, 1947-1958. The files used were found in FCP.

RDF — Richland Diversification Files, Collection 1314, DOE Historian's Office and Archives, Germantown, Maryland
Items cited from this collection are generally given with Box and Folder numbers, e.g. 5:2.

RPL — Richland Public Library

RPL-CF — Richland Public Library Clippings Files (or Vertical Files), including "Historical File, Reference Office"

SSR — Spokane Spokesman-Review

ST — Seattle Times

TCH — Tri-City Herald

USBC — U.S. Bureau of the Census

WGMP — Warren Grant Magnuson Papers, Accession 3181, Manuscripts and University Archives, University of Washington Libraries
This collection has been subdivided by period, so that Magnuson's first two senatorial terms, 1945-1956, for example, are in Accession 3181-3. In the notes, this subdivision of the accession is given as WGMP-3. Items from the collection are generally cited with box and folder numbers, as in 97:20.

CHAPTER ONE

Building a Factory and a Village: Hanford and Richland, 1942-1946

The development of the Hanford Engineer Works (HEW) during World War Two was governed above all else by two sets of circumstances. First, the U.S. Army Corps of Engineers raced under unusual wartime pressures to build an enormous industrial plant that utilized untested technologies. The plant had to be completed quickly in order to keep to the tight schedule mandated by the U. S. Army for the Manhattan Project's effort to build an atomic bomb. The project required an immense amount of expertise, labor, and building materials, at a time when each of these commodities was in short supply. It demanded tremendous secrecy, despite its immense size, and it entailed the construction of a permanent set of facilities, including a whole new town, even though it was not clear that these facilities would be needed after the war. And on top of all these pressures, there was the distinct possibility that the project might fail to achieve its goal, in which case it was certain to be investigated closely after the war. HEW was built and began operations at a time when nothing about it could be explained, not even its own importance. But its builders lived under the fear of having to explain--and justify--everything, <u>especially</u> if it did not succeed.

While the first set of circumstances affected virtually every part of the Manhattan Project, the second set revolved

around the peculiar siting of HEW. Hanford's production reactors and separation facilities had to be isolated from major population centers and from the ocean coasts, yet at the same time required close proximity to ample amounts of fresh water and electricity, and some access to transportation lines. The Hanford area in south central Washington was one of the very few eligible places in the country for such a project. Yet, both during and after the war, it became apparent that the very environs that seemed so suitable as a site for a wartime plutonium plant were not so ideal for such other needs as recruiting an adequate workforce, housing a new town, or containing the plant's many wastes. Nonetheless, once the wartime decision to locate the plant at Hanford had been made in necessary haste, the government, its contractors, and Hanford employees and their families became wholeheartedly committed to remaining at Hanford. There would be no turning back, and little second-guessing.

* * *

The choice of Hanford as site for part of the wartime Manhattan Project illustrated precisely how the American Far West came to be selected after 1942 for more than its share of federal atomic and nuclear weapons facilities. The region was attractive in large part because it seemed empty. It was not heavily populated, compared to the East, and its expanses of apparently vacant land seemed ideal for absorbing the impact of weapons manufacture, assembly, and testing. The region also seemed to promise tighter security for top-secret work because its

remoteness could isolate facilities from inquisitive eyes. Furthermore, in the years before the later 1970s, the West's economic underdevelopment encouraged many of its elected officials to embrace federal programs as sources of additional revenue for their states and towns. Such considerations help to explain the decision by November 1942 to build a laboratory for perfecting and assembling atomic bombs at Los Alamos, New Mexico. The following month, the Manhattan Project began selection of Hanford as its second far western site.

The decision to build at Hanford was consciously made in order to transfer scientific discovery (or its application) from the cities to the provinces. On December 2, 1942, scientists at the Manhattan Project's Metallurgical Laboratory, at the University of Chicago, achieved the world's first controlled nuclear chain reaction, and thereby demonstrated how a pile or reactor could produce plutonium. Even before this historic first, however, the Manhattan Project's scientists and engineers intended to build the world's first, full-scale, production reactors, piles 500 million times as powerful as that in Chicago. A "scaling-up" of such unprecedented dimensions, to be conducted without much knowledge of radiation's dangers, required isolation of the plant from major population centers.[1] Thus it would not be constructed in or around Chicago or Oak Ridge. Between December 14 and 16, 1942, Manhattan District officers, MetLab scientists, and du Pont engineers met at du Pont headquarters in Wilmington, Delaware, to develop specifications for siting the plant. Aware that the plant would generate an enormous amount of

dangerous wastes, they determined to build the reactors and processing facilities in a vacated expanse of at least 200 square miles, at least 20 miles away from any town with more than 1,000 residents. To ensure secrecy, the plant also had to be at least 10 miles away from the nearest public road or railway. At the same time, operation of the facilities would require almost immediate access to both a fresh-water flow of at least 25,000 gallons per minute and at least 100,000 kilowatts of electricity.[2]

To find such a place, Brigadier General Leslie Groves instantly dispatched Colonel Franklin T. Matthias, of the Army Corps of Engineers, and A.E.S. Hall and Gilbert Church of du Pont, to the Far West, "with an investigation of the Grand Coulee area [to be] made first." Locations along the Columbia River doubtless appeared especially attractive, not only because of the heavy flow of cold, clear water but also because of the abundance of hydroelectricity generated by the New Deal's recently completed dams. On December 22, 1942, Matthias flew over north central Oregon and south central Washington. He held out little hope for the "productive wheat land" along Oregon's Deschutes River, but the arid territory in the vicinity of the towns of White Bluffs, Hanford, and Richland, Washington looked "far more promising." Matthias drove around the area the following day and reported on it favorably to Groves by phone. After investigating additional sites in California, he returned to Washington, D.C., and recommended the Hanford site to Groves on the last day of 1942. Groves and Matthias returned to the vicinity on January

16, 1943 for a final look, but they had already set in motion the process by which the U.S. government would acquire the land. The Hanford Engineer Works ultimately occupied 670 square miles, or about 428,850 acres, in Benton, Franklin, and Grant counties.[3]

This isolated site, located in an agricultural region that was accustomed to a slow pace of change, suddenly became home to a flurry of activity. On the banks of the Columbia, the construction gangs under the Army Corps of Engineers, du Pont, and Stone and Webster, with a multitude of subcontractors, built Hanford's reactors and the rest of the structure necessary to produce plutonium: roads and electrical systems, water works to carry water from the Columbia through the reactors and back to the river, a factory to ready the uranium fuel to be loaded into the reactors, and the chemical separation facilities to extract plutonium from the processed uranium reactor fuel. Through the construction of the B reactor, and its wartime fellows, the D and F reactors, Hanford's workers and managers learned to manipulate them to meet the production schedules imposed by the Manhattan District. It was in this period that the practices of managing graphite production reactors were worked out, and patterns set which persisted throughout the life of Hanford's production mission.

In November, 1944, just over two years after Colonel Matthias selected Hanford as the Manhattan project's plutonium production center, Hanford's B reactor produced its first samples of plutonium--nicknamed "postum" for security reasons--which began to be delivered to Site Y, the Los Alamos laboratory, in

February 1945. Those two years represented the culmination of half a decade of scientific research on the physics of uranium fission, which was translated first into an experimental reactor at the University of Chicago, under the auspices of the Metallurgical Laboratory, and then into an industrial semi-works supervised by DuPont's engineers.[4] Hanford represented something different from the test of a set of scientific theories (a fact that was not always recognized in the course of occasional friction between the scientists and the engineers on the site[5]), yet its success stemmed directly from a series of just such tests within the scientific community.

The American development of the theory of artificially-induced uranium fission went back to January of 1939, the same month that Columbia river water began to pool up behind the newly completed Grand Coulee Dam. At the Carnegie Institution of Washington, a hastily-assembled experiment confirmed reports from Germany that neutrons of proper energies could prompt uranium nuclei to break apart. Niels Bohr, among those gathered for a scientific meeting at George Washington University, had proposed that the rare, odd-numbered isotope, Uranium 235, was the unstable one. Chemical reactions, including conventional explosions, drew their energy from the forces which normally held electrons to nuclei in atoms. Because the energies binding together a heavy nucleus were so much greater, if a nuclear explosion could be created, it would be one of tremendous magnitude.[6]

As the physicist Leo Szilard and others soon realized, for such a reaction to be explosive, it would have to be rapid and self-sustaining: a chain reaction, in which each fissioning uranium nucleus released neutrons, which could collide with other uranium nuclei and extend the fission process. Laboratory research in the U.S. and Great Britain established that U235 tended to fission, and that a concentrated lump of it, in a quantity which seemed possible to obtain, would explode.[7]

The year 1939 brought many shocks and worries. In September, west coast physicists were together at the Seattle meeting of the American Physical Society when they learned of the beginning of World War II. Students of the Berkeley physicist E.O. Lawrence were soon prominent in efforts to establish the routes by which an atomic bomb might be built, and Lawrence himself in 1940 joined the effort to mobilize scientific resources for war. East coast physicists, encouraged by Szilard, discussed the possibility of voluntarily keeping their research results secret, although an international accord was not reached.[8] Government committees began to consider the possibility of nuclear weapons. In December 1940 at Berkeley, Glenn Seaborg discovered the first indications of the existence of a new element, artificially created in the Berkeley cyclotron, which he named "plutonium." He and his collaborators isolated and identified the element in late February, 1941, and then began to gather information about it. Its most common isotope had a nuclear mass of 239, making it a likely candidate for explosive

fission, according to explanations advanced by Bohr about the behavior of heavy nuclei.[9]

Plutonium emerged as a parallel route to a nuclear explosion: a uranium bomb would depend on the Americans' ability to separate U235 from the much more common U238, a process that would require sorting the two chemically-identical substances based on the differences in their masses. The new element, plutonium, represented a way to make use of U238, by transforming it into plutonium in a reactor. As this process began to be sketched out, first in the Columbia laboratory of the emigrant physicist Enrico Fermi, who had done research on neutron physics in Italy, and then at the Chicago Metallurgical Laboratory, it depended on a self-sustaining reaction in a nuclear pile. Literally a stack of uranium and moderating material, the pile slowed neutrons produced by uranium fission, to an energy where they induced further fission in the U235 (providing a continuing source of neutrons for the process); fast neutronswere captured by the more abundant U238. The result of this last interaction, U239, decays in 23 minutes into neptunium, an intermediate product which in turn decays into plutonium. Thus the reactor was to act, on the small scale, as a neutron factory, sustained by the neutron-induced decay of U235 and employing excess neutrons to transform U238 into plutonium. On the large scale, then, the reactor would take tons of uranium fuel and produce grams of plutonium. Los Alamos would undertake to learn how to assemble a few kilograms of plutonium to create an explosion.

The theory of nuclear piles awaited experimental proof and then scaling up to regular production. Scaling up, and learning how to manage the plants once in production, took the project away from the realm of theory and laboratory experiment. It was decided that both the experimental pile in Chicago and its sucessors would use graphite as a moderator, rather than heavy (deuterium-rich) water; Fermi and Szilard had used graphite in their New York experiments, and large-scale heavy water production would have required another complex and expensive industrial plant.[10] In May 1942 Fermi's first Chicago experiments proved that controlled nuclear fission could be achieved, and his crew set about building a working model, completed in December of that year. The semi-works, or production pilot plant, was initially planned to be built in a park outside of Chicago. Instead, the semi-works were set up at the more-isolated Clinton, Tennessee, so as not to endanger a heavily-settled area with the larger pile, and the Argonne site in Illinois became a center for reactor development, first with the re-assembly of Fermi's experimental pile and then with the construction of a heavy-water moderated pile.[11]

That December, Matthias visited the Hanford, Washington site, which he and Groves soon selected for the production reactors. Matthias, other Army officers, and du Pont observers tended to view the site as relatively unprosperous and unproductive before their arrival, and disparaged much of the site as marginal grazing land. But Hanford was hardly empty before 1942. Native Americans had occupied and utilized the

lands for centuries, and since the later 19th century non-native settlers had developed ranches, orchards, and irrigated farms on them. Most of these enterprises did not flourish during the 1930s, however, a fact that doubtless heightened the impression that the lands were not very valuable. Local irrigation districts had taken over some failing farms during the Great Depression, and the townspeople in the village of Hanford had abandoned some buildings. The office of Spokane architect G. Albin Pehrson, hired to lay out the new community of Richland, noted the absence of sewers, the shortage of plumbing facilities, and the crude, small type of homes in the Richland area before 1943 as evidence of the area's general poverty. "The houses themselves were of dubious quality, as one might expect in an area where shelter had usually to wait for the productivity of the land," Pehrson wrote.

> Having no capital or barely enough to acquire property and the minimum tools for its development, most of the ranchers and their families were forced to live as best they could. In this respect they were not unlike the farmers of the Middle West who spent their money on barns or other productive improvements, but neglected their homes. Only the Richland residents were poorer; the country was young.[12]

Official opinion of economic conditions notwithstanding, the sudden announcement in February 1943 that the government was taking over more than 600 square miles, and initiating more than two thousand separate condemnations of private land, shocked and

angered local residents. The project's secrecy doubtless heightened frustrations: people could not even learn why they had lost their homes. Many of those being evicted protested the prices offered them by the Army for their land, and sued for more money. The uproar was such that local Congressman Hal Holmes, fearful of the combined effect of the condemnations upon his constituents, reminded Matthias that because "he had not been involved in the selection of the site, he did not want any credit for it and asked that I convey that attitude to the local people whenever the occasion demanded."[13]

The Army separated almost all people from their homes and lands on the site; only a handful of people, who got work on the project, stayed behind in their homes, and they now paid rent to du Pont for the privilege. Even the dead were evacuated. The government exhumed 177 burials from the White Bluffs cemetery and reinterred them in the nearby town of Prosser.[14]

Only Native Americans managed to retain some of their rights to the site. Members of the Wanapum tribe, who had made their winter home along Priest Rapids on the Columbia, had to relocate. Matthias provided them only limited access to the reserve during the war, although Frank Buck recalls that his people were promised they could return to fish the river "when this is all over." Matthias also promised to "treat Indian graves which we fine [sic] with reverence and dispose of the bodies in some reasonable way." Both the Yakima and Priest Rapids Indians proved more insistent on their rights to fish the Columbia River from reserved lands. Matthias first offered them cash in return

for yielding their treaty rights to the fish, and they refused. He then offered to have the government fish the river and bring the catch to them, and they refused again. Finally, the Army agreed to provide a truck and driver to transport them daily to and from Priest Rapids during fishing season, but they would not be permitted to fish without supervision or camp there overnight.[15]

In condemning privately held lands for HEW, the Army established certain priorities. It wished first to begin construction of the reactors and chemical separations plant, on the northern part of the site just south of the Columbia River. Consequently, it evacuated the villages of White Bluffs and Hanford immediately, and began erecting in their stead a temporary construction camp. It simultaneously moved into Richland, some twenty-five miles south of the construction site, and began building a new village and administrative headquarters there. Yet, unlike the inhabitants of White Bluffs and Hanford, residents of Richland had until November 15, 1943, to vacate their homes.[16]

In due time, Richland would become a carefully planned and enduring town. On the other hand, the Hanford camp, as the construction town was known, would explode upon the scene in 1943 and then be completely abandoned in less than two years. Du Pont built Hanford camp to house the workers during construction of the first three production reactors, two chemical separations canyons, and assorted other facilities. It erected Richland in order to house the employees who would administer and operate the

plant. Both communities can be seen as cogs in a huge industrial machine, laid out in many respects with no goal in mind other than to speed production. In the early days of the atomic bomb project, the Danish physicist Niels Bohr had warned American scientists that they could only get the needed quantities of fissionable material by "turning the whole country into a factory." The development of HEW, and the building of Hanford camp and Richland village, validated Bohr's prediction. This <u>industrial</u> story--less glamorous, perhaps, than the scientific story--has been slighted by historians, but it is every bit as important and as complicated.[17]

In parceling out responsibility for different parts of the Manhattan Project, General Groves had placed the more scientific endeavors under the supervision of universities and the more industrial endeavors under the supervision of manufacturing companies. He convinced E.I. du Pont de Nemours and Company, Inc., the giant chemical concern, to build and operate Hanford during World War Two. This choice was regularly second-guessed during the war. Franklin Matthias wondered, after a few months at Hanford, whether du Pont had an adequate conception of the scale of its part of the project. More importantly, scientists at the MetLab in Chicago often criticized du Pont's caution, expertise, and management skills. At one point they proposed to "eliminate du Pont from all work except that of the chemical separation plant," and spoke as if they, the university scientists, could themselves better supervise the design, construction, and operation of HEW.[18] This was absurd. Although

du Pont seemed to move slowly, its industrial experience, its engineering orientation, and its cautious policies actually staved off chaos and ultimately assured the timely success of Hanford. Du Pont's corporate culture may have been much too rigid and hierarchical for the scientists. Yet, in retrospect, most observers agreed that du Pont's organization, engineering, and management saved the day, and credited the company with achieving a safety record at Hanford that was far better than the records of those sites under university supervision.[19] As Groves had understood from the start, it took one industrial organization to build another.

The scientists' complaints about du Pont, and General Groves's constant pressure on Matthias, stemmed primarily from the extreme urgency pervading the project from start to finish. Americans hurried to beat the Germans to the first atomic bomb. Once the German threat had disappeared, Manhattan Project officials raced to complete, test, and utilize atomic bombs against Japan, and before the war ended. Such urgency pushed construction and operations at Hanford at a pace that would have been inconceivable outside of wartime. It also led to a number of frustrations. The design of the first reactor was changed routinely, even though construction was under way. Building crews delayed progress on their own volition because they knew that they were proceeding with certain tasks "out of scheduled order." In a variety of instances, officials omitted certain reactor safeguards and lowered materials standards in order to save time. Late in 1943, when instructing du Pont to install

certain water-treatment accessories on the second reactor but not the first, Colonel Matthias explained HEW's priorities in no uncertain terms: "our first requirement is the early production of some material, and...our second requirement is a large quantity of material."[20]

To produce the reactors and separations plant that would produce the material, Matthias needed to find an enormous labor force, and this proved a very difficult task. When du Pont and the Army began recruiting workers for Hanford, they found themselves competing against other employers, including the armed services, which enjoyed a head start in mobilizing for war. Moreover, they had to lure workers to a remote spot in a remote corner of the country, a site selected not for its good living and working conditions but rather for its isolation and its accessibility to water and electricity. Some who were familar with the vicinity were not eager to go work there. Nell Lewis MacGregor, a 57-year-old widow from Seattle, initially resisted offers of employment at Hanford because she regarded the climate around Pasco as unbearable. She only consented to work there months later, after an intense recruiting effort and the offer of an "incredible" salary.[21] Others less familiar with the area agreed to come but then departed quickly because the living and working conditions seemed so unpleasant. Francis McHale, who had come by rail from Pennsylvania to set up police and fire departments for du Pont, recalled his arrival: "The wind was blowing like hell, and if a train were going back east right away I would have been on it." Trains deposited many recruits at the

station in Pasco during the very early morning hours; General Groves insisted that they be housed and fed then so that they would not simply leave before they could begin working.[22]

In pressing forward with recruiting, du Pont and the Army enlisted the help of the U.S. Employment Service and the War Manpower Commission, which were not always cooperative; appealed to unions to send members to Hanford; and dispatched employment agents throughout the country in pursuit of able-bodied workers. Recruiters made a special effort to appear on construction projects such as the Alcan Highway, where they expected layoffs or shutdowns. The only state they did not canvass was Tennessee, which recruiters from Oak Ridge monopolized.[23]

Despite the far-flung efforts, there never seemed to be enough workers during the construction phase at Hanford. According to one account, the project had no more than 50 to 70 per cent of the labor force it needed through the spring of 1944. Only in June of that year could Matthias report having, for the first time, "almost enough laborers and craftsmen to accomplish the work scheduled." And even then there remained shortages of certain kinds of skilled labor. Later in 1944, when the project required trained pipe-fitters for completing the three piles, the Manhattan Engineer District (MED) furloughed enlisted men from active duty, enrolled them in reserve units, and employed them as civilians at Hanford, with a promise to reinduct them into the Army if their work proved unsatisfactory. Matthias and du Pont protected other highly skilled personnel, which the project could

not afford to lose, by reaching agreements with local draft boards.[24]

Although HEW employed a number of men who might have been serving in combat, it relied more heavily for its work force upon those people who were not the Selective Service's top choices. Slightly more than half of all employees were 38 years or older, and therefore above the maximum drafting age, and three-quarters of those between 18 and 26 years old had 4-F ratings. Nell MacGregor recalled a number of "strange characters" at Hanford camp, including the mentally and physically disabled. The project employed thousands of women as well during World War Two; about thirteen per cent of its construction force was female.[25]

Workers came to Hanford from all around the country as well as from Canada. Observers recalled many "good people from the Midwest, who were patriotic and willing to work hard." More than recruits from the Southwest, apparently, these employees from the Midwest wanted to bring their families with them, which challenged the Army and du Pont to provide more housing and schools than they had planned.[26] Many employees--both black and white--came as well from the South. Non-whites accounted for 16.45 per cent of Hanford's construction work force. Citing the need to produce results quickly, Manhattan Project officials segregated African Americans in their own quarters at Hanford camp. "This was no place to risk racial conflict."[27]

The policy of segregating workers made Matthias reluctant to recruit workers of Mexican ancestry, because--believing that whites, African Americans, and Hispanics would refuse to live

among each other--he preferred not to spare the time and resources to erect still another set of segregated facilities. The War Manpower Commission nonetheless regarded Mexican-American laborers around Texas as the most readily available and urged HEW to hire them. Groves and Matthias yielded to this request early in 1944, although Matthias noted that, with spring work imminent on Texas farms and ranches, few "Latin-Americans" chose to migrate northward. Those who did were housed near Pasco, off the Hanford site and away from the other workers.[28]

After recruiting diverse people from all around North America, du Pont and the Army faced a stiff challenge keeping them at Hanford. Early in the project, Matthias reported a monthly employee-turnover rate of 10 per cent. Throughout most of 1943, he had to delay construction of the plant so that workers could concentrate on building the barracks and other amenities needed to retain workers. Yet in June 1944 the turnover rate was 21 per cent. Between 1943 and 1945 Hanford recruiters interviewed more than 260,000 people and ultimately hired 94,307 of them, for a revolving work force that ranged as high as 45,000 in June 1944--still below the desired number.[29] Trying to slow the rate of turnover, Groves ordered fairly detailed exit interviews, and Matthias found that those who quit cited three major reasons for their dissatisfaction: the isolation of the site; the miserable living conditions; and the sense that Hanford was not vital to the war effort.[30]

The secrecy surrounding Hanford, and its uncertain fate, encouraged a transient mentality even among those who lingered

there. Few people had much reason to stay on because it was not clear whether Hanford would remain open after the war, one migrant from Salt Lake City recalled, so people "operated accordingly."[31] Once word of Hanford's footloose workforce got around, Matthias had to take time away from his own recruiting efforts to fend off other employers, including other districts of the Army Corps of Engineers, who wanted access to people leaving Hanford. Furthermore, toward the end of 1944, as victory in Europe seemed nearer, he continued to remind employees of the need to finish the job at Hanford.[32]

In order to keep workers on the job and at the same time get the most out of them, Groves and Matthias played a delicate game of simultaneously pushing and pleasing Hanford employees. They instituted a five-and-a-half-day, and then a six-day, work week in order to make up for the labor shortage, and they required ten-hour days. Although some employees undoubtedly grumbled at the hours, many appreciated the opportunity to make extra money.[33] General Groves also instructed Matthias to make sure that du Pont tried to keep workers content by, for example, having foremen, craft supervisors, and other leaders appreciate the importance of making "what job adjustments are necessary to keep the employees reasonably well satisfied." The Army expected du Pont both to make improvements to the camp in order "to maintain morale and hold people on the job" and to respond vigorously to complaints about unsafe working conditions.[34]

The resolute secrecy of the Manhattan Project compounded the problems of a labor shortage, as it did everything else. One of

workers' complaints about employment at Hanford was that they did not know what they were building and so could not feel sure that they were making enough of a contribution to the war effort. At the same time, however, greater awareness of Hanford's mission might have driven labor away from the site by revealing the risks associated with plutonium production. General Groves generally feared letting the workers learn too much about the invisible dangers surrounding Hanford. As the time for starting up the first reactors neared, du Pont executives in Wilmington ordered their managers at Hanford to practice a "complete evacuation" of the 100 and 200 areas as well as the construction camp. Groves and Matthias refused to allow such a potentially alarming drill, and permitted instead only a limited evacuation of the 100B and 100D areas. In his diary Matthias explained that a wholesale drill "might be disastrous to the project as it might cause a large number of people to leave if their fears for safety were increased. It would also be sufficiently upsetting so that we could expect a serious effect both on security and manpower facilities to finish the job." Vetoing du Pont's request, the Army determined that, for the sake of efficiency and secrecy, construction workers ought not to learn about all of Hanford's unsafe working conditions. General Groves and Colonel Matthias, protecting "the best interests of the United States," would take no steps to alert employees to the many of the risks they faced by working at Hanford.[35]

Keeping workers on the job also entailed dealing with complaints from organized labor. Unions regarded du Pont and the

Army as generally "anti-labor," and with some justification. Yet, Hanford presented a number of problems that simply defied the peacetime conventions of industrial relations. Du Pont, for example, had undertaken the work at Hanford at no profit to itself, so it could not be approached as a typical employer. Unions leaders, including the Teamsters' Dave Beck, found it very difficult to resist Matthias's appeals to their patriotism. Furthermore, such problems as shortages of certain craftspeople, the creation of unprecedented positions for which no union had any trained members, and the overriding need for secrecy--which prevented union agents from visiting the work site and prevented some workers from describing all of their jobs to union agents--forced organized labor to become accommodating. Delays occurred as well when union locals themselves clashed over which one would represent workers on a certain task at Hanford. Matthias, acting under Groves's specific instructions, tried to keep organized labor happy, but he also kept his eye out for "agitators" and regularly reminded unions of his commitment to efficiency above all else at Hanford.[36]

Negotiations between management and organized labor were but one illustration of the larger theme of HEW's immense impact upon the society and economy of the Columbia Basin. Although the Army wished to keep as low a profile as possible at Hanford, the sudden arrival of tens of thousands of people, coupled with tons and tons of supplies, could not remain secret. Some viewed these developments as a threat, while others saw them as an opportunity. Matthias had to cope carefully with each set of

reactions. He tried to reassure other employers, including units of the federal government, who feared that HEW would absorb too many local workers, or drive up local pay scales, or destroy nearby agriculture. He also listened to a number of the region's businessmen promoting their services and supplies to the project. Washington state's elected officials appeared regularly before him as well. Congressman Holmes, who had asked Matthias to absolve him of blame for siting the project at Hanford, also pleaded the case of local growers who feared that HEW would take away their labor supply. U.S. Senator Mon Wallgren protested that Hanford workers got too little time off work to vote in the November 1944 election. And Governor Arthur Langlie, afraid that the state might have to support any workers left behind by the project after the war, urged Matthias, once the work was done, to arrange "to return most of the construction workmen back to their original centers of activity, particularly the negroes."[37] No politician wanted his career damaged by the secret project.

Although Groves and Matthias tried to provide satisfactory answers to the inquiries of private citizens and public officials, they were handicapped in responding by their need to maintain security. Indeed, protecting the secrecy of the project amounted to another immense task. Matthias and Groves refused to permit an inspection of Hanford, even by a member of Senator Harry S. Truman's Special Committee to Investigate the National Defense Program. They also tried to counteract a "revelation" by U.S. Senator Warren G. Magnuson, who told the public in January 1945 that du Pont would produce "nitrates, plastics, and nylon

hosiery" at Hanford after the war.[38] By far the most persistent known threats to Hanford secrecy were regional newspapers, which seemed to Matthias to be bent on spreading information about the project, despite his requests not to publish unscreened articles.

The press presented more problems at the beginning of construction, before Matthias and the Army had mastered the art of managing editors and reporters. In April 1943, after publication of a fairly accurate article on Hanford by a Lewiston, Idaho, newspaper, Matthias lamented that "trying to restrict publicity on this project is like keeping water in a sieve." In the following months he talked continually with editors and reporters, trying to get them to withhold from publication stories about Hanford that his office had not approved. This often proved difficult, because each newspaper believed that its competitors were not restraining themselves as much as it was. Matthias tried to encourage cooperation by promising friendly newspapers that he would give them special treatment once the real Hanford story broke. By the time he had to live up to this promise, when the President and Army announced that an atomic bomb had been dropped on Hiroshima, Matthias had learned how to deal carefully with the press.[39] From the very start, for the sake of both efficiency and security, administrators sought to manage news about the project.

Although the Army wanted Hanford to maintain a low profile, its presence created problems that could not be ignored. The advent of thousands of newcomers placed enormous pressures on surrounding communities and obligated the MED to provide

assistance. It tried to ease the housing shortage and school overcrowding that the project created in Benton and Franklin counties by working with local governments as well as other federal agencies. Nonetheless, the towns of Pasco and Kennewick, with populations of 3,913 and 1,918, respectively, on the eve of the project, were especially hard hit by the flood of newcomers. Kennewick, which had grown to about 7,500 people by March of 1945, became home to many trailers housing Hanford employees and their families. Pasco, which also hosted a naval station, became the chief entrepot and off-site playground for project workers, and attained a population of about 8,500 by March, 1945. Matthias worried in particular about the "unbearable load on the facilities, both social and law enforcing, of the Pasco area."[40] Kennewick, Pasco, and the towns of the lower Yakima River Valley would never be the same.

When the Manhattan Project arrived in south central Washington, its expectations for the surrounding communities had been fairly high. The Army intended to build the village of Richland, inside the boundary of the military reservation, to house "those for whom security requirements or emergency need dictated they they be constantly at hand and under control." But it did not initially plan for Richland to have many of its own commercial, civic, or medical facilities, because it assumed that the surrounding area would be able to provide them. This assumption soon proved erroneous, however, as the towns nearby became instantly "overtaxed." By June of 1943 plans for Richland were modified to allow for more shops and services. The changes

to Richland were needed in part, again, to keep workers content. While making the village more of an autonomous community, however, the Army simultaneously created the lasting distinctions between its new town and the neighboring communities. The new housing and ample services at Richland would cater more to "key supervisors and essential office workers," Matthias noted. The "houses, hotels, trailers, plain board shacks and tents" of Kennewick and Pasco, on the other hand, "were, for the most part, occupied by mechanics and common laborers and their families."[41]

Although some wartime construction workers lived off-site, the Army and du Pont crowded most of them into the living quarters known as Hanford camp. Du Pont picked the old, evacuated Hanford townsite as the location for the construction camp because it was close to the 100 and 200 areas, had some buildings, a water system, and electrical utilities that could be used by the camp, and featured a branch line of the Milwaukee Road railway. On top of this infrastructure, du Pont erected a temporary, self-contained town complete with housing, mess halls, recreation facilities, and a variety of services. Residents initially lived in tents, between May and October of 1943. By the time of its peak occupancy in mid-1944, the camp had: 131 barracks for 24,892 men and another 64 barracks for 4,357 women; 880 hutments for 9,834 men; and 3,639 trailer lots. The total capacity of the camp exceeded 51,000, but actual occupation reached "only" about 48,000. Probably 45,000 or so of these were employed on the project, while the rest consisted mainly of some workers' family members, who were permitted only to live in

trailers. To feed the residents of the barracks and hutments, du Pont built eight mess halls which had a combined seating capacity of 19,500. In keeping with the segregation that prevailed in living quarters, white waitresses served the food in the mess halls and African-American women cleaned up afterwards.[42]

Although Hanford camp earned a certain notoriety, it should be remembered that it was simply a larger version of the kind of rough-and-tumble community--like mining, lumber, and other contruction camps--that emerged in the American West whenever a hard-working, well-paid, heavily male population was concentrated temporarily in one spot. Many observers recalled abhorrence for the crudity of the place, yet some also found pride in meeting the challenges the camp presented. Women in particular felt enormous pressure, as Jane Hutchins from Kansas recalled:

> we were living behind barbed wire at Hanford, all to protect womanhood. I know that where women were concerned, Hanford could either make you or break you. Gals who had never had male attention before were, you know, popular. You could either become a slut, I suppose, if you wanted to, or you could become very strong, and be able to say "No."

Some of those who passed the tests presented by Hanford camp found that the townsite, and the larger project, were such compelling experiences that they simply could not leave. Nell Lewis MacGregor, who worked as a supervisor in one of the women's barracks, and who witnessed firsthand the workmen's widespread gambling, "razor wielding," and "dangerously inflammatory" racial

slurs, found herself thriving in such an atmosphere: "Had I ever willingly left a three alarm fire when the excitement was at its height? I had not. The thrill of this was comparable."[43]

For workers not so captivated by the excitement, the Army and du Pont devised various programs to lift spirits, increase productivity, and discourage leaving. In later 1943 Matthias oversaw the development of a fairly extensive recreation program that included live entertainers, movies, organized athletics, and beer. He also encouraged formation of the H.E.W. Employees Association, which published weekly "a local project paper to boost morale." The Sage Sentinel, as it was called, mainly reiterated the many other messages directed at employees. "Kill That Rumor As You Would a Snake," one headline urged, and "Let's All HEW to the Line." For security reasons, the newspaper was forbidden outside the project boundaries.[44]

The supervisors at Hanford also attempted to keep employees within the project boundaries. To keep workers from going home for the holidays (and possibly not returning), du Pont and the Army staged a number of "special Christmas activities." Matthias noted that "Both white and colored activities are to be given emphasis commensurate with the numbers of each."[45] And when employee complaints about living conditions increased or when the number of departures grew unusually high, Matthias and others tried to respond. In May 1944 they investigated electrical workers' complaint about high prices for goods at project stores, and the following month they reversed a decision to institute cafeteria service in the mess halls because the workers preferred

the existing "family style service."[46] General Groves himself applied pressure on Matthias to improve camp conditions in order to bolster morale, and on three occasions between February and June of 1944 he backed up his orders by visiting Hanford and speaking to crowds of workers about the importance of their contributions.[47]

The Army spent a great many resources on Hanford camp between mid-1943 and mid-1944, but these investments were made in what was essentially a transitory town. As the dates for completion and start-up of the B, D, and F reactors and chemical processing plants drew near, du Pont began planning to close and dismantle Hanford camp and to lay off thousands of the construction workmen who would not be needed for operations. In February 1945, following start-up of the third reactor, access to the townsite as well as to the 100 and 200 areas was "limited to individuals having an Operations pass or a Construction one-day tag pass issued by top supervision." Workers vacated the last barracks on February 23, 1945, and one departing employee recalled the arrival of new tenants: "The Army Engineers turned into [the camp] an abandoned flock of goats they ferried from the other side of the river. Whether this was an act of mercy or for experimental purposes, we didn't know." Now without a camp where "they can be completely taken care of," Matthias found, "the common labor class" were no longer "interested in working here if they have to live off the project."[48] By the same token, the project managers--now much less worried about turnover in the

labor force--were no longer concerned with housing and boarding the "common labor class."

The common laboring class had provided the basic skeleton within which the reactors began to come to life. These reactors differed from the first experimental pile in design as well as size. In addition to the selection of a graphite moderator, other design decisions were made in the course of planning the production reactors. Fermi's original pile had used lumps of uranium arranged as lattice points within the stack of graphite bricks.[49] The designers realized, however, that it would make little sense to set up a pile so that it had to be disassembled in order to remove the plutonium-tinged uranium for processing and plutonium extraction. As constructed, the Hanford plants were designed on this model: a stack of graphite 36 feet square and 28 feet deep was pierced with holes, round in cross-section, from three directions. From the front, the holes held aluminum pipes (process tubes) which carried cooling water and cans of uranium fuel; holes from the side carried control rods used to manipulate the reactor's power level, and holes from the top were provided to accommodate safety rods which could drop in to the pile and stop the reaction in case of emergency.[50] The process tubes, running through the pile, allowed the reactor to be reloaded by inserting new canned uranium slugs into the front of the reactor, forcing processed fuel out the back.

Construction began on the site of Hanford's first pile, the B reactor, in August 1943 and continued to September, 1944.[51] As the pile neared completion, the Army's supervisor of the

production areas began to plan for testing and loading the reactors, including a limited evacuation test. "No stampede or panic was observed," he noted with satisfaction; "all persons walked in an orderly fashion to designated areas." Much of his time was taken up with thinking about the practical details of plumbing, such as making sure that the uranium and water-carrying process tubes not only had a minimum clearance for the uranium fuel cans, but also that the exit end was slightly larger, in case they began to bulge as a result of their trip through the reactor.[52]

The cans filled with uranium represented an important problem in the development of the production reactors. Along with graphite, aluminum became a crucial material in the construction of the Hanford reactors, but for the opposite reason: aluminum has relatively little effect on neutrons traveling through the pile. Thus the process tubes were made of aluminum, as were the cans which held uranium slugs together and made up the reactor's fuel supply. By canning the uranium, several goals were achieved: the fuel stayed out of direct contact with the cooling water, lowering the level of contamination resulting from its passage through the reactor. Also, canning kept the uranium in a form in which it could be easily loaded into the reactor, extracted, and transported to the processing facilities, where the plutonium was to be harvested from the package after the aluminum was dissolved in an acid bath.

The problem was finding a method to close the aluminum jacket around its load of uranium fuel. Work on this problem continued as construction of the first reactor progressed; to prepare for the possibility that the problem would not be solved on time, Hanford's management also laid in and prepared a supply of unjacketed uranium metal with which to load the reactor. The main problem was soldering aluminum in contact with uranium, a ticklish process which was achieved by developing a dipping procedure to load lead solder into the seams.[53]

When the first pile was started up, it appeared to be self-poisoning, something which had not shown up in the operation of the smaller prototype piles during the course of research and design. Dealing with this event became perhaps the most often-repeated story from Hanford's early history; the culprit was a radioactive isotope of xenon, which absorbed neutrons and so stifled the chain reaction. The solution was fairly straightforward: by providing the pile with extra uranium fuel, excess neutrons were produced to overcome the quickly-decaying xenon by making sufficient neutrons available for the reaction, over and above those captured by the xenon. Still, the xenon always lurked at low powers, and set a fundamental limit to the time Hanford's reactors could be shut down before restarting became a laborious process of again banishing it, expending neutrons which could be used instead to produce plutonium. Hanford's operators learned to keep a budget of "reserve reactivity" to provide them with time to restart in case of a partial shutdown of the reactor.[54]

The episode, which delayed the B-reactor's steady operation by several days, was easily resolved because the du Pont engineers had designed extra slug channels into the reactor pile, giving substantial safety margin for extra fuel loading. Thus, "by luck," according to physicist Henry Smyth in 1945, the engineers provided an avenue for escape when unexpected circumstances arose in the full-size reactor. More recently, David Hounshell has pointed out that luck had little to do with the happy event.[55] Rather, du Pont's designers had great experience with the process of scaling up from process tests to semi-works and then to full-sized plants, and engineers generally know very well that scaling effects can be practically unpredictable, and that large mechanisms--whether water wheels, aircraft, or chemical processes--typically behave differently than models. Hanford was firmly in the realm of engineering rather than science by the time its plants went into operation, despite continuing "Farmer runs" in which material samples were loaded into the process tubes to provide Fermi (codenamed Farmer by the Manhattan District) with continuing information about the reactor's workings.[56]

With the B reactor in operation, followed by D and F, Hanford began a sprint to produce sufficient plutonium for a fission weapon. Captain F. A. Valente, one of the engineers who oversaw construction and operations, kept careful track of the benchmarks along the way. "At 2215 the [B reactor] powerlevel (sic) was raised from 245 MW to 250 MW and thus reached the design operating power level of the pile," he noted on "day 132,"

Sunday, February 4, 1945. On March 28, all three piles operated at their designed power levels for the first time. July 4 was also a red-letter day: "The 100th batch of product was delivered by the Contractor," Valente noted.[57] Supervising the discharge and handling of ten tons of irradiated uranium fuel, as it moved from a reactor to the separation facilities, became a weekly task.[58]

The beginning of operations at the B reactor both inaugurated Hanford's plutonium-production phase, which would prevail for more than twenty-five years, and brought an end to the construction phase at HEW during World War Two. With the completion of B, D, and F, Hanford camp was abandoned in February 1945. Looking back, a number of participants (and a few historians, too) regarded the transition as an end to all the excitement. One who made the move from Hanford camp to Richland, and from construction to production, remembered the feeling: "Those of us going into operation knew that Richland Village was a nice little place, unique of its kind, but it was going to seem pretty colorless after the roaring construction camp."[59] Plutonium production may not have seemed as thrilling as the race to build the plant in the first place, but operations was the norm for which HEW had been designed. Although it appeared dull or routine to some, production looms as the biggest and most important story of Hanford.

In moving from construction to operations, the focus of social activity moved from the old Hanford townsite to Richland. Hanford had been designated a camp, while Richland was called the

village. The camp had been thrown together in haste, while Richland was planned relatively carefully. Hanford camp was supposed to endure only as long as construction lasted, while wartime Richland became the foundation for a permanent city. Almost all the construction workers moved on as expected, while many operators and their families remained behind in Richland and helped to build the Tri-Cities. Whereas Hanford camp had housed primarily working-class men and women, Richland catered to more middle-class operators, engineers, administrators, and their families. In light of the differences between the two places, only a few people made the move from one to the other. One who did, Nell MacGregor, recalled how Richland seemed so much more comfortable after the crudity of camp life: "we felt unspeakably elegant in rooms with plastered walls, painted woodwork and splinterless floors."[60]

Although the completion of Richland was a less urgent priority than finishing Hanford camp, both were conceived and begun in the spring of 1943. However, neither started from scratch. As with Hanford camp, the Army and du Pont superimposed a new village on the older town and vicinity of Richland. The Army condemned the townsite and surrounding farms early in 1943. It saved more than 150 houses to use for the project, along with a number of stores and irrigation works, but most vestiges of the old community were destroyed. One observer recalled passing through in October 1943:

> There was a service station, a first-aid place, some contractors' shacks, and acres of land swirling with dust as trucks moved over it. Houses had been razed here and sagebrush scraped off, and building materials in vast quantities were being stacked ready for use.[61]

The new village simply overwhelmed the old.

Although the Army and du Pont planned Richland more carefully than Hanford camp, and intended it to last longer, they nonetheless hurried to complete it. As a result, its form evolved in much the same way as did the design for the wartime reactors: builders debated and altered it even in the midst of construction. The debates and changes stemmed in large part from three different considerations. First, the intended size of the village grew from under 7,000 in March of 1943 to over 15,000 by early 1945, and as a result the Army and du Pont had continually to add more facilities.[62] Second, the Army's initial thinking about the village was ambivalent. On the one hand, it wanted "to serve minimum needs and no more."[63] On the other, the minimum needs of operators and their families apparently amounted to considerably more than the minimum needs of construction workers. The Army realized that it needed housing that would keep production employees content and on the job. Third, while the Army possessed one vision of how the village should turn out, du Pont held quite another idea, calling for greater physical comfort and convenience. And because du Pont assumed responsibility for erecting and peopling the new Richland, it had a decided influence on the final outcome.

Orders to build the village as cheaply as possible came from the top. General Groves wanted inexpensive housing at all three

Manhattan Project townsites, and he continually reminded Matthias to keep housing in Richland "to the bare essentials," in part by utilizing existing buildings and facilities from the old townsite as much as possible. Groves's thinking on the subject mirrored his views on the larger project, as one journalist noted in 1946: "If the atomic bomb was a dud, [the Army] might have to account for every dollar to a cold-eyed Congressional committee. So nothing went into Richland that wasn't 'necessary.'"[64]

Yet, the "bare essentials" required for operations employees in Richland differed significantly from the minimums required for construction crews at Hanford camp and for "general operating labor" living off-site. From very early on, the Army and du Pont regarded village housing as somewhat exclusive. Some "construction people" would reside there until their work had ended, Matthias explained, but then they would have to leave. He further assumed that the kinds of working men and women who had built the plant did not aspire to the same kinds of homes that operators would desire: "it appears that people who will not be required to live in the village, will be the people whose housing standards are none too high."[65] On the other hand, because operators' housing standards were higher, the Army could not risk spending too little on Richland. Roger Williams, one of du Pont's managers at Hanford, sized up Richland's future residents as "a distinctly higher type than that encountered in the usual war emergency project."[66]

As the contractor responsible for building the village, du Pont had a great deal of input in deciding what kind of housing

constituted the minimum required for operators and their families. It took an even keener interest in the subject because those operators would be du Pont employees. The company was essentially charged with building a community for itself, and for this reason, too, it hesitated to skimp on the town. Throughout 1943 it negotiated with the Army to upgrade the quality of housing. The Army at first apparently proposed barracks and dormitories, instead of a town of homes, but it soon agreed with du Pont that it needed "a complete Village at Richland with minimum facilities for comfortable living."[67] Over the ensuing months du Pont made it clear that its minimums for comfortable living exceeded the Army's, and especially General Groves's. In April 1943 du Pont proposed a plan that included some 3-bedroom houses, prompting a command from Groves to reduce the plan "to the bare essentials." Groves complained again in June that du Pont's designs (drawn up by the Spokane architectural firm of G. Albin Pehrson, a du Pont subcontractor) remained too extravagant, and he instructed Matthias (who perhaps had become more sympathetic to du Pont) to reduce costs once more and eliminate such frills as a funeral parlor for the town. Groves also criticized du Pont's plan for grouping the bigger and better houses in the village, rather than mixing the different kinds together. He worried that such clustering "will tend to give the appearance of a mill town. This is neither desirable from a utilitarian point of view nor from the landscaping and planning point."[68]

When completed, wartime Richland represented a compromise between the visions of du Pont and Groves. As a result of the general's efforts to economize, the town wound up with inadequate numbers of sidewalks, garages, stores, and shopping areas, no civic center, and roads too narrow for much auto traffic. All of these "savings" would present problems in the postwar period when Richland expanded considerably. Wartime Richland also had its share of temporary housing--25 dormitories by 1945--so that it could house both construction and operations personnel when those two phases of Hanford's development overlapped.[69]

But du Pont's influence was also unmistakable. Colonel Kenneth D. Nichols, one of the top officers in the Manhattan Project, noted that Groves got his way at Los Alamos, where the housing was rather spartan, while du Pont succeeded in building nicer homes in Richland.[70] G. Albin Pehrson, the architect-engineer, justified the relatively spacious housing and block layout by referring to a need to protect the morale of workers:

> there would undoubtedly be a psychological hazard in a too-cramped plan. Although city dwellers are confined to narrow lots and restricted views, these are an accepted part of their environment. In the desert, where space is the key characteristic of the view, a cramped village of cramped houses would be out of character, a palpable and conscious discord.

Designers hoped to ease the adjustment of the families of workers "transplanted to what will probably seem a strange country."[71]

Good housing was essential for helping employees cope with the mid-Columbia country.

Apart from building better housing than Groves had wanted, perhaps du Pont's greatest success at Richland was keeping the town from being fenced in. Once construction of the village had ended, Groves and Matthias fully intended to build and patrol a fence around it, just as had been done at Oak Ridge and Los Alamos. They wished to keep operations personnel "under control for security reasons" and at the same time prevent access to Richland from outside the project. But du Pont objected to such controls over the townspeople and apparently succeeded in changing the Army's mind.[72] The Army would still police Richland and watch its residents carefully--wartime censors examined each departing letter; security personnel listened in on phone calls; hotel porters acted as "counter-espionage agents"--but the village would never become a city inside a fence. In fact, because it remained open for popular inspection, Matthias ultimately asked du Pont to ensure that it always looked tidy and proper. The village would serve as the only "point at which public attention will...be directed and the opinions reached by the general public as to the manner in which Richland will operate will extend in their minds to the rest of the project."[73] The village had to be a model community in order to give the correct impression of the entire HEW. None of the vices associated with the Hanford camp or Pasco could be allowed to thrive there.

The growth of the village, while not as spectacular as Hanford camp's, was nonetheless explosive. The population, which numbered 250 before the war, climbed to a peak of 17,000 in mid- and later 1944, as the construction and operations phases overlapped. The size of the village then began to decline by spring of 1945, and by the end of the year Richland contained approximately 15,000 people.[74] Through 1943, most of the residents worked in construction, and the remainder worked for the Government. Beginning in January 1944, however, operations personnel began arriving, in prepartion for startup of the reactors. By March they had become a majority of the population, and thereafter construction employees steadily departed Richland.[75]

Many of the newcomers came with the help of du Pont's Resettlement Group, which moved operators, their families, and their belongings from around the country to Hanford. The employees usually arrived first, and stayed in Transient Quarters and dormitories until their houses were ready. Family members arrived later and remained in Transient Quarters until their household effects could be moved in. The process did not always run smoothly. In May of 1944, builders completed new houses faster than the occupants' furniture could be shipped and unloaded.[76]

In virtually all cases, each employee's rank determined his or her housing assignment. Less desirable houses (the duplexes dubbed Types A and B, and the "Prefabs") were assigned to people in the "Operator to Foremen Classifications"; small, single-

family homes (Types F and H) went to the "Shift Supervisor to Assistant Shift Supervisor Classifications"; and the better single-family houses (Types D, E, and G) went to "Chief Supervisors" and their superiors. (Note that housing types, like reactors, were designated by letters of the alphabet.) Du Pont's "eligibility list," which determined who had priority for new housing when it opened up, "was prepared from the organization chart by beginning at the top and continuing down the line through various job classifications until all eligible employees were listed." Once surplus housing became available, at the conclusion of construction in early 1945, some people who had not before been eligible--including school teachers and truck drivers--could now occupy houses or dormitories in Richland. However, "laborers, janitors, and other manual workers" remained excluded from residing in the town.[77]

Operations personnel arrived from every part of the country. Of the 1,532 employees moved by du Pont to the village between February 1944 and January 1945, 858 came from states east of the Missouri River and 674 came from the West. Although not all operators had worked for du Pont before, the largest numbers transferred from the company's ordnance plants in Colorado, Tennessee, Utah, and Illinois, where production had slowed or stopped. Of the 238 coming from Illinois, for instance, many had worked at the Kankakee Ordnance Plant, and then spent 8-12 weeks training for their new positions at Oak Ridge before going to Richland.[78]

Although the inhabitants of Richland came from many different backgrounds, they formed a cohesive community rather readily. This can be explained in part by the relative homogenity of the adult population, which was overwhelmingly white, generally possessed a good education, earned relatively high wages, and reportedly fell into the same general age bracket of 30-40 years. The intense, shared experiences of training for a new kind of work, arriving from elsewhere, and operating a top-secret plant also doubtless hastened the formation of community, and perhaps so did the town's isolated, self-sufficient, and mass-produced appearance. The townspeople also shared feelings of satisfaction in helping to shape a brand-new community to their collective tastes, and putting down roots there. One reporter explained Richland in 1946: "The majority of its men are scientists and engineers, with common interests and a common point of view. The town is their baby and they love it."[79] Finally, just as the Army and du Pont encouraged the formation of the HEW Employees Association at Hanford camp, they assisted in the development of Villagers, Inc. to serve similar functions in Richland, including publication of a weekly newspaper called The Villager.[80] This was one of more than fifty social organizations and thirteen churches that helped to hold together the instant community.[81]

The operation of Richland, like the design of its housing, represented a compromise between du Pont and the Army. As an unincorporated town, the village "had no political powers." Located on a federal reservation, it was subject to all rules and

regulations issued by the Army, as well as all relevant county, state, and federal statutes. Yet the Army had hired du Pont to run and police the town as part of its job as Hanford's general contractor, and du Pont wished to operate Richland "without any Army control or checking." Matthias, on the other hand, did not wish to yield a blank check to the company, partly because he objected to du Pont's fairly rigid way of doing things: "du Pont Company officials solve a problem...with their approved solution being the same as the manner in which that problem was handled by them in the past."[82]

The tensions between the Army and du Pont reached a head in September of 1944, just as the plant prepared to begin production, when du Pont complained that the Army was interfering too much in the affairs of the village. In building Richland, the Army had wanted to skimp on expenses while du Pont had wished to spend more; in operating the village, these roles were reversed. W.O. Simon, du Pont's manager at HEW, called the Army "liberal" in its treatment of residents and pointed out a number of instances where the Army had demonstrated too much initiative in providing services to townspeople. Du Pont's more "conservative" approach, according to Simon, "would avoid any activity or endeavor not necessary to its immediate needs and would tend to follow rather than anticipate public opinion." The Army, for example, promoted the formation and operation of the Villagers, Inc., while du Pont resisted the idea of this organization of residents, perhaps perceiving it as a threat to the company's hegemony in running the town.[83] Ultimately, a

compromise was struck. The Army did not withdraw completely from its involvement in Richland, and it did not repeal the initiatives it had already undertaken. But Matthias did give the contractor a fairly free hand to operate Richland as it saw fit, subject to his final "veto power." And by the spring of 1945, after some early difficulties, the village seemed to operate smoothly.[84]

Du Pont's duties at Richland ranged widely. It assigned and rented housing to residents, and set up a Tenant Service which, by April of 1945, responded to more than 100 calls daily--many of them for such tasks as changing light bulbs. The government instructed the company to make the town pay for itself, and by early 1945 it generally did, although the government made no effort to amortize its original investment in Richland.[85] Du Pont also leased out stores and offices to commercial tenants, and checked to ensure that local retail prices remained in line with those in nearby towns. The company furnished buildings and equipment for Richland's schools and, at the Army's request, added the Richland Nursery and Extended Day Care School as well. This latter facility was designed explicitly to enable "mothers of small children to accept offers of employment" on the project during the labor shortages of 1944. The effort to employ more women represented something of a change in plans, because in April of 1943 it had been assumed that "The very nature of the [production] process itself precludes the use of many women in operating areas." Even when women were employed, it was assumed that their capabilities were limited to "following carefully

outlined proceedures or carefully given instructions....[They] are by no means capable of carrying out tests or analysis without prior instructions." In any case, however, most mothers proved unwilling to accept jobs at Hanford. They cited "housekeeping difficulties and lack of proper laundry facilities" as "two prime factors contributing to their reluctance."[86]

In admitting to "housekeeping difficulties," women acknowledged the troubles posed by the area's notorious windstorms which deposited thick layers of dust inside even the best new homes. These dust storms suggested something of the project's impact upon the local environment. Because of the region's aridity, its agricultural practices, its high winds, and its gritty soil, dust storms had plagued the vicinity even before 1943, but construction of HEW clearly intensified the problem. Builders excavated 25 million cubic yards of earth during wartime construction. At both Hanford camp and Richland village, they "scraped off the sagebrush to put up the buildings," and left behind too little topsoil and too few plants to prevent wind erosion. At the camp, MacGregor recalled, "To keep the sand where it belonged, they dumped carloads of gravel all over the place."[87] At Richland, the physicist John Marshall remembered, "They bulldozed the place flat, got rid of whatever topsoil there was and brought in silt from the Yakima River flats." Du Pont then planted public areas itself, and issued grass seed free of charge to tenants so they could install lawns. These measures doubtless held down some of the topsoil, but severe dust storms continued to buffet the village and irritate its residents.[88]

(The project did not uproot the entire area. Mindful of wartime food shortages, it preserved several orchards, both inside and outside of the village, and contracted with Federal Prison Industries, Inc. to have inmates from the McNeil Island Federal Penitentiary harvest the fruit.[89])

Dust storms were hardly the only--or most important--effect of wartime HEW upon the local environment. Operation of the production reactors and separations plants led to the release of radioactive and toxic wastes into the air, the soil, and the water. The designers of Hanford knew about some of the dangers presented by the plant prior to construction; after all, fearing an accidental release of radioactivity, they had isolated the plant from existing centers of population. As early as April 1943, Matthias initiated efforts to detect and reduce the plant's impact on Columbia River salmon. Du Pont and the Army also worried, before construction began, about climatic conditions--including dust storms--which might bring concentrations of radioactive gases from the chemical separations facility into contact with workers on site and people living off-site. Rain storms, too, might carry radioactivity out of the stack gases from the separation plants and deposit it on "the ground near the plant in undesirably high concentration." As a rule, then, irradiated fuel cans were not dissolved in acid, the first step in the separation process, when it was raining, although tests were undertaken during rain storms in order to measure the actual results of the process.[90]

As early as November of 1942, du Pont had calculated that "The biggest problem is how to get rid of large quantities of waste materials" generated during processing. "For one ton of metal from a pile worked up to provide one gram of X-10 and one gram of fission materials, 8,000 gallons of hot material must be handled." The immense risks inherent in plutonium production, understood even before Matthias had visited the Hanford site for the first time, made it mandatory that the Army indemnify its contractor against future liabilities: "In a du Pont contract, the Government must provide protection for du Pont in regard to hazards."[91]

Hanford began its first serious environmental monitoring in January, 1945, and operation of the plant under wartime conditions began to provide indications of the problems to be encountered in operating on such a large scale.[92] To begin with, the most spectacular concern, the reactors running out of control, proved to be only a minor concern. After the initial startup of the B reactor, the operator's main worry was keeping the chain reaction alive; as time went on, an explosive accident came to be regarded as a quite remote prospect. Small amounts of radioactive gas escaped from the reactor buildings, and while the cooling water picked up radioactive contaminants passing through the reactor, the most short-lived decayed away in cooling ponds on the site, and the rest were believed to be diluted to an acceptable level in the Columbia. Radioactive hazards were much more likely to come from the processing facilities than from the reactors themselves, and operations were undertaken with an eye

to both wartime needs and the conditions under which contaminants left in greater concentration or were carried farther by the winds over the Columbia basin.[93]

For a variety of reasons, the dangers of Hanford releases were never fully or widely realized during wartime, and adequate safeguards against them were not implemented. Knowledge of the specific dangers of plant byproducts grew tremendously during the war, but remained rather limited nonetheless. Scientists only belatedly realized that radioactive iodine gas, released from stacks atop the processing canyons, posed a serious health hazard, so their steps to deal with that problem came slowly. Imperfect meteorological knowledge at the start of construction served to compound the problem. For example, scientists who worried about "stack gases of the Separations Plant" figured that the prevailing winds would blow them eastward, over the site of the Hanford camp which they assumed would be abandoned after operations started. By the end of the war, however, it was understood that the prevailing winds blew not from the west but from the northwest, and thus carried "active gas over Richland and vicinity." From that point, continental winds then tended to carry emissions toward the northeast. By 1945 and 1946, scientists monitoring the radioactive iodine released from the separations stacks had grown concerned about its implications.[94] Yet, they flatly denied that Hanford's operation had presented any airborne health risks:

> All gases and fumes emitted by the pile and by the chemical separation process exhaust stacks were

> examined carefully in order to prevent any hazard to the plant areas and to the surrounding region. Continuous checks were made for the presence and amount of radioactive gases by the use of recording analysers and film packs. This equipment was in strategic locations in the immediate vicinity of the three installations, with other units at distances up to several miles from the stacks. No hazardous concentrations were found at any time.[95]

Environmental monitoring during wartime was less than thorough, especially by contrast to more recent standards, in part because the Manhattan Project was not sure what to look for and did not have adequate equipment. Similarly, the plant managers had no sophisticated techniques for disposing of liquid wastes other than storing them in underground tanks or pouring them into the ground. Even when Hanford's dangers became known or suspected among scientists and managers, furthermore, they were not publicized. On July 12, 1944, Matthias met with Army officers and du Pont scientists and managers to discuss informing plant operators about the hazards of their work. The group decided that people working inside or close to buildings in the 100 and 200 Areas, which housed the reactors and processing equipment, "will be told that there is a hazard," while those "who normally work away from the 100 or 200 Areas will not be given any specific warning." And since all information about workplace dangers remained classified, it was not to be shared

with employees' families living in Richland or with people living off-site.[96]

Wartime exigencies dictated haste at the expense of safety and environmental concerns. Du Pont and the Army "took risks to get results" because they were in a hurry. They also cut corners with the expectation that such emergency conditions would last only a short while and that more effective safeguards would be introduced once the war ended. And, in fact, better procedures for monitoring releases of radioactive iodine were installed between October and December of 1945, even though many gaps remained in experts' knowledge. Releases of radioactive iodine diminished substantially after 1945.[97]

The greater caution exerted after the war stood in marked contrast to the tremendous haste that characterized the first seven months of 1945. The scientists at Los Alamos needed as much plutonium as they could get, and as quickly as possible, in order to finish development of the bomb, so Groves placed intense pressure on HEW to deliver plutonium. The processing buildings yielded their first "units" of material on February 2, 1945, and the next day Matthias drove the substance to Portland and carried it with him on a train to Los Angeles, where he handed the plutonium over to an "agent from Los Alamos."

This marked the start of the "speed-up" during which du Pont ran the reactors above their rated power level, and allowed the irradiated fuel rods to cool before processing for a much shorter time than was safe, in terms of gaseous emissions from the processing plants. Shipments to Los Alamos became more regular,

leaving HEW every five days, and by May they went by truck rather than train in order to save time. Oppenheimer in Los Alamos and Groves in Washington, D.C. continued to push Matthias for more production, and Matthias in turn pushed operations employees. Worried about diminishing morale after the victory in Europe, Matthias reminded du Pont on June 8, 1945 that there remained "the general and immediate need for as much product as possible." By the end of July HEW had pulled out all stops and delivered shipments to Los Alamos by airplane.[98] Groves continued to push for heightened production until the day Japan surrendered. Even then, Matthias worried about whether the announcement of peace would hamper production. He also reminded all employees that the strict wartime security measures remained in force.[99]

Operations at Hanford during 1945 highlighted the industrial role played by the site in the Manhattan Project and afterwards. Once the plants began production, the Hanford site lived up to its designers' intent as a vast factory. As the operations staff replaced the corps of construction workers, five main functions characterized Hanford's work: preparation of reactor fuel, operation of the reactors, separation of plutonium from the processed fuel, waste disposal, and administration of the site and the town of Richland. Thus a culture of production came into being, one reflected both in Hanford's technology and in its social arrangements.

Production was the key. Within the plant, Hanford's staff became adept at manipulating the production reactors to keep them in operation and meet the tight timetable established by General

Groves for plutonium for the atomic bomb project. Their solutions tended to emphasize a high level of hands-on knowledge and direct problem-solving techniques. With operations under way, the reactors reflected engineering and production values, rather than theoretical ones. Production values were also reflected in local attitudes toward the atom bomb. Herbert M. Parker, looking back twenty years later, recalled that a petition opposing use of the bomb had circulated at Oak Ridge during 1945. "The attitude [at Hanford] was more to the point," Parker explained. "The belief was that we were here to make an explosive device, and we got about the job."[100] From the start Hanford's "work culture" emphasized production and a "can-do" ethos, and these orientations continued to shape the design, operation, and spirit at Hanford's facilities after the war.

The frenzy of production and delivery during the spring and summer of 1945 generated the fissionable material necessary for perfecting the design of the plutonium bomb, testing the device at White Sands, New Mexico, on July 16, and dropping an atomic bomb on August 9 on Nagasaki, Japan, where it killed perhaps 70,000 people. These events marked the culmination of years of intense work and of about $350 million of expenditures on Hanford ($253.52 million for construction of the main plant, $44 million for Richland, and $51.9 million for special construction such as the Hanford camp area). The dropping of a uranium bomb on Hiroshima, Japan, on August 6 had provided the Army with a chance to publicize the Manhattan Project, and HEW's mission, for the first time. Journalists deluged Richland in the days following

President Truman's announcement of the new weapon, visiting the plant and the village. The following week, Matthias spoke about HEW in Walla Walla, Spokane, and The Dalles. The news, coming as the war ended, was received with optimism. In the positive glow of peacetime, it seemed natural to tout Hanford's potential for non-military uses.

> Thus the atomic pile is actually a three-in-one plant: It creates large quantities of plutonium. It produces a host of valuable new radioactive elements. It liberates a vast amount of atomic energy, which today goes to heat the Columbia, but promises more utilitarian applications for tomorrow.[101]

For years this kind of thinking would tantalize--and often frustrate--inhabitants of the communities surrounding Hanford.

Information about HEW's past mission and future prospects was particularly welcome in Richland and vicinity. Employees who had not known the goal toward which they were working now felt relief and pride that they, too, had contributed in important ways to the war effort. The mood was generally upbeat, as evinced by the first Richland Day celebration on September 3, 1945, which resembled a county fair. Yet there was apprehension as well. Once employees learned what they had been making, they inundated du Pont's Medical Department with questions about the dangers of the workplace. In all but one case, the contractor reported, the Industrial Physicians calmed these fears by reassuring workers "that no one has received any injury from the special hazards associated with operations."[102]

As Hanford's mission became public, there was less skepticism from the public about the once-secret plant. Politicians and business people had once worried about the project's unfavorable impact upon them, but Hanford quickly became a source of pride. To some it also seemed to be a business opportunity. Mrs. J.W. Nichols of Grants Pass, Oregon, wrote Colonel Matthias on August 17, 1945 with an offer to sell uranium ore to the Army. She was sure that her ranch in eastern Oregon could supply some of the needs of the Hanford Engineer Works. "Thot [sic] maybe you folks who make the bombs would be interested in finding the ore close at hand....I am a widow of a Vet. If interested please answer this." After signing her name, Mrs. Nichols added, "P.S. Your bombs are certainly wonderful."[103]

* * *

With the end of the war, a group of new questions came to the fore: Who would operate the site now? What was the peacetime role of the plutonium production process? How permanent was the Hanford Engineer Works? The answers to these questions came over the next year or so as activities at Hanford began to wind down and become more routine. Employment on the project had actually been shrinking since the conclusion of construction, and Richland's population had also peaked in the spring of 1945. Now the consolidation of HEW accelerated. Late in September of 1945, HEW had about 6,500 government and contractor employees; thirteen months later, the total was 4,800. Meanwhile, the village population dropped from about 15,400 in March 1945 to between 12,750 and 13,100 for the first ten months

of 1946. And in sharp contrast to the situation at Hanford camp, women made up 51 percent of the adults in the village in October 1946. HEW continued laying off employees, so that between September 1945 and December 1946 the number of contractor personnel dropped from 10,000 to 5,000. In September 1945 it also approved du Pont's request to reduce the working week from 48 to 40 hours, while increasing wages by 10 percent.[104]

Things may have seemed calmer at Richland and Hanford, but they were hardly normal. The project had been conceived, built, and operated during wartime, and the pressures that accompanied war had been the norm until mid-August 1945. In the early post-war months, peace represented the aberration, and it seemed to bring uncertainty and decline. The B reactor was shut down temporarily in March 1946 while the D and F reactors ran at reduced power levels. The Army worried about the future of the reactors in 1946, because "Expansion of the graphite is limiting the life expectancy of the piles." In November of that year, the government estimated that "safe operations can be continued for at least two years."[105] Beyond that, the future was cloudy.

Furthermore, the main contractor itself, du Pont, announced that it would leave Hanford. In 1942 du Pont had only reluctantly agreed to build and operate Hanford for the duration of the war, largely out of a sense of patriotic duty, and once peace came the company wished to get out of the nuclear industry. It doubted that it could recruit the physicists it might need to continue such work, and it doubted whether nuclear energy could become a profitable line of operations for the company. It also

simply wished to pursue other commercial and research opportunities, particularly those "free of government involvement." So du Pont informed General Groves that it would withdraw from the Manhattan Project upon expiration of its contract in May 1946. Groves failed to change the company's decision, but he did persuade it to stay on until October 1946, by which time a successor could be found.[106]

Few American corporations had much interest in replacing du Pont at Hanford, and even fewer were qualified to do so. The Army gave serious consideration, according to Colonel Nichols, to only Westinghouse and General Electric, because "these two companies had a basic interest in commercial atomic power development." Nichols preferred G.E. because it had "more chemical capabilities"--a critical criterion at HEW--and du Pont concurred in the recommendation. So on September 1, 1946, General Electric became the prime government contractor at Hanford, beginning a career of more than two decades there.[107]

One more transfer of authority remained. During late 1945 and 1946, the U.S. government and Congress in particular debated how to control atomic energy, and decided that a civilian agency should prevail. In August 1946 the Congress created the Atomic Energy Commission, and on January 1, 1947 the Army yielded its control over HEW to the new agency. The AEC's presence at Hanford would continue for twenty-seven years.[108]

Although GE and the AEC would remain at Hanford for a long time, in late 1946 they did not know for sure where Hanford was headed. Its role during World War Two had been clearly defined,

but its role in peacetime remained rather uncertain, particularly in light of the aging reactors. The advent of the cold and Korean wars would bring a reinforced sense of mission to Hanford and Richland. But when the demand for plutonium waned in the years after 1960, people wondered, just as they had in 1946, what future now lay in store for Hanford and Richland.

NOTES TO CHAPTER ONE

1. On its first day of operation, Fermi's pile developed about one-half watt of power. Richard G. Hewlett and Oscar E. Anderson, Jr., The New World, 1939/1946, vol. I of A History of the United States Atomic Energy Commission (University Park, Pennsylvania, 1962), 112; Henry DeWolf Smyth, Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under the Auspices of the United States Government, 1940-1945 (Princeton, 1945), 98, 112, Appendix 4.

2. E.I. du Pont De Nemours and Company, Inc., "Design and Procurement History of Hanford Engineer Works and Clinton Semi-Works," December 1945, Wilmington, Del., on file, PRR, #IN-6263, I:18; FTM, Dec. 14, 15, 16, 1942; "D.S.M. Chronology," Nov. 10, Dec. 10, 14, 1942, MEDPR, Box 181.

The story of site selection (like many other key topics) is covered by Hewlett and Anderson, The New World, 188-190, 212-213. This volume should be consulted for detailed descriptions of the physical facilities at Hanford.

3. "D.S.M. Chronology," Dec. 14, 1942; FTM, Dec. 22, 31, 1942, Jan. 16, 1943; du Pont, "Design and Procurement History," I:49; E.I. du Pont De Nemours and Company, Inc., "Construction, Hanford Engineer Works, U.S. Contract No. W-7412-Eng-1, Du Pont Project 9536, History of the Project," MS Vols I & II, August 9, 1945, Wilmington, Del., on file, PRR, #HAN-10970, I:2; A.E.S. Hall and Gilbert P. Church, "Special Plant Site Location Investigation," January 2, 1943, MEDPR, Box 53.

4. David A. Hounshell, "Du Pont and the Management of Large-Scale Research and Development," in Peter Galison and Bruce Hevly (eds.), Big Science: The Growth of Large-Scale Research (Stanford, 1992), 245-254; David A. Hounshell, Science and Corporate Strategy: Du Pont R&D, 1902-1980 (New York, 1988), ch. 16; Hewlett and Anderson, The New World, 186-210 passim.

5. Hounshell, "Du Pont and the Management of Large-Scale Research and Development," 245-254.

6. Hewlett and Anderson, The New World, 10-14, 27-29; Vincent C. Jones, Manhattan, the Army. and the Atomic Bomb (Washington, D.C., 1985), 21-26.

Probably the greatest strength of Richard Rhodes's popular history, The Making of the Atomic Bomb (New York, 1986), is its exposition of the prewar physics situation and the assimilation of the discovery of fission. Rhodes, Making of the Atomic Bomb, chs. 9-10.

7. Hewlett and Anderson, The New World, 42.

8. Spencer Weart, "Scientists with a Secret," Physics Today

9. Hewlett and Anderson, The New World, 33-42; Jones, Manhattan, 28-34. On the discovery of plutonium by Seaborg, see Glenn T. Seaborg, The Plutonium Story: The Journals of Professor Glenn T. Seaborg, 1939-1946, edited and annotated by Ronald L. Kathren, Jerry B. Gough, and Gary T. Benefiel (Columbus, OH: Battelle Press, 1994), p. 29.

10. Hewlett and Anderson, The New World, 55-56, 68; Smyth, Atomic Energy, 40-41, 147-48.

11. Smyth, Atomic Energy, 110-14; Hewlett and Anderson, The New World, 190-91, 207-212; Jones, Manhattan, ch. 5; Rhodes, Making of the Atomic Bomb, p. 428.

12. du Pont, "Construction, Hanford Engineer Works," I:4, 6, 8; Office of G. Albin Pehrson, Architect-Engineer, "Report on the Hanford Engineer Works Village (Richland, Washington)," Nov. 1943, p. 8.

13. Hewlett and Anderson, The New World, 213-14; FTM, June 18, March 5, 1943.

One complaint against the Army's condemnation proceedings was registered by M. Grace Merrick of Dearborn, Michigan, who owned 59 acres in the northwest corner of the reservation. Referring to the lack of adequate explanation for the condemnation and the price paid for her land, Mrs. Merrick asked, "Could a totalitarian gov't be more high handed?" Her letter prompted an investigation by the Army, including a check on her own character. See M. Grace Merrick to Col. K.D. Nichols, Aug. 28, 1943, and accompanying correspondence, in MRCF-DF, Box 10.

14. du Pont, "Construction, Hanford Engineer Works," I:7.

15. S. L. Sanger, Hanford and the Bomb (Seattle, 1989), 12; FTM, April 2, 1944, Sept. 15, 1943; F.T. Matthias to Field Project Manager, E.I. du Pont de Nemours & Co., Inc., May 24, 1943, MEDPR, Box 42; "Monthly Field Progress Report, Hanford Engineering Works," April 30, 1944, MEDPR, Box 46.

16. du Pont, "Construction, Hanford Engineer Works," I:6.

17. Niels Bohr cited in Rhodes, Making of the Atomic Bomb, 500; Ferenc Morton Szasz, The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion July 16, 1945 (Albuquerque, 1984), 15.

18. FTM, June 17, 1943; K.D. Nichols, The Road to Trinity (New York, 1987), 71, 84, 136-37.

19. Nichols, Road To Trinity, 83-84, 140-41; Herbert L. Anderson, "Assisting Fermi," All In Our Time: The Reminiscences of Twelve Nuclear Pioneers, ed. Jane Wilson (Chicago, 1975), 98;

Leona Marshall Libby, Uranium People (New York, 1979), 169-71; U.S. Atomic Energy Commission, "Report of the Safety and Industrial Health Advisory Board" (Washington, D.C., 1948; AEC-10266), passim, esp. 5, 7, 9, 21, 38.

20. FTM, Dec. 1, 2 (qtn.), 28, 1943; Michele Stenehjem Gerber, On the Home Front: The Cold War Legacy of the Hanford Nuclear Site (Lincoln, 1992), 42-43.

21. Paul John Deutschmann, "Federal City: A Study of the Administration of Richland, Washington, Atomic Energy Commission Community" (M.A. thesis, University of Oregon, 1952), 14-15; Nell Lewis MacGregor, "I Was at Hanford," MS on file, Nell Lewis MacGregor Papers, University of Washington Manuscripts & University Archives, 1969, pp. 7-9; Hewlett and Anderson, The New World, 215-16.

22. Sanger, Hanford and the Bomb, 86; FTM, July-Aug, 1943.

23. FTM, Sept. 9, 23, Oct. 6, 12, 1943; Ted Van Arsdol, Hanford...The Big Secret (Richland, 1958), 18-23.

24. P-I, July 16, 1985; Fraklin T. Matthias, "Monthly Field Progress Report," June 1944, MEDPR, Box 46; FTM, Sept. 4, 13, 1944; Van Arsdol, Hanford...The Big Secret, 26.

25. MacGregor, "I Was at Hanford," 42; Van Arsdol, Hanford...The Big Secret, 26; Richard I. Newcomb to E.B. Riley, Nov. 22, 1944, in "Diary, Book 1--H.E.W., 6/26/44 thru Dec/31/44," MEDPR, Box 24.

26. TCH, Jan. 28, 1973, RPL-CF "General Electric - Hanford Works thru 1959"; FTM, June 4, 1943.

27. Newcomb to Riley, Nov. 22, 1944; MacGregor, "I Was at Hanford," 35.

28. FTM, Sept. 29, 1943, Feb. 18, 26, Mar. 3, 1944; Franklin T. Matthias, "Monthly Field Progress Report, Hanford Engineering Works," March 31, 1944, MEDPR, Box 46. The precise ethnicity and nationality of these workers of Mexican ancestry remain unclear. Although Matthias wrote about "Mexicans," "Latin-Americans," and "Spanish-Americans," it seems most likely that the employees were Mexican-American. They were supposed to be citizens, and tended to be recruited from the state of Texas.

29. FTM, June 3, 1943; "Monthly Field Progress Reports," June - December, 1943, MEDPR, Box 46; Van Arsdol, Hanford...The Big Secret, 50, 23.

30. Van Arsdol, Hanford...The Big Secret, 50.

31. Frank Zelley, cited in TCH, Mar. 12, 1978.

32. FTM, Dec. 11, 1943, May 22, Sept. 27, Oct. 19, 1944.

33. D. H. Denham, E. I. Mart, and R. K. Woodruff, Notes From Key Former Handord Employees Workshop on Vegetation Data Biases and Uncertainties 1944 to 1948, September 19-21, 1988 (Richland, 1988), 5; Van Arsdol, Hanford...The Big Secret, 22; FTM, July 23, 26, 1943.

34. FTM, Oct. 11, 13, 1943, April 13, July 22, 24, 26, 1944.

35. FTM, Aug. 23, 24, 28, 1944. See also the pointed correspondence between du Pont and the Army: Roger Williams to Major General Leslie R. Groves, Aug. 24, 1944; Groves to Williams, Aug. 26, 1944; Williams to Groves, Aug. 30, Sept. 1, 1944; all in MEDPR, Box 52. Cf. the September, 1944, entries in Captain F.A. Valente, "Daily Diary, Captain Valente, 9-44 thru July 1945 [sic], 100-F Area," PRR, #MED-1001 through #MED-1004.

36. FTM, April 11, 15, May 24, June 12, July 22, 24, Sept. 7, 8, 13, 1944, April 23, June 21, 1945.

37. FTM, April 21, Aug. 18 (qtn.), 1943, Feb. 25, Nov. 6, 1944.

38. FTM, Dec. 7, 1943, Jan. 31, Feb. 27, 1945; "Future Assured," Business Week (Feb. 3, 1945): 41.

39. FTM, April 19, 1943, July 4, 23, 1944, Aug. 7-9, 1945.

40. du Pont, "Construction, Hanford Engineer Works," I:2; F.T. Matthias to District Engineer, Oak Ridge, Aug. 4, 1945, MRCF-DF, Box 91; W.A. Rothery, "Population Figures--Hanford Engineer Works," April 11, 1945, MRCF-DF, Box 8; FTM, Dec. 21, 1943.

41. Matthias to District Engineer, Oak Ridge, Aug. 4, 1945; F.T. Matthias, "Conference Notes," April 1, 1945, MEDPR, Box 182; Pehrson, "Report on the Hanford Engineer Works Village," 6, 8.

42. du Pont, "Construction, Hanford Engineer Works," I: 42, 43; MacGregor, "I Was at Hanford," 51. A special census of the entire Hanford Engineer Works, presumably including Richland, counted 52,709 people in July of 1944. The racial and sexual breakdown of this population was as follows: 34,007 white men; 13,044 white women; 4,650 "colored" men; and 796 "colored" women. There were, in addition, 212 military personnel, male and female, on site. F.T. Matthias to William S. Gibson, July 15, 1944, in "Diary, Book 1--H.E.W."

43. TCH, Mar. 11, 1973; Sanger, Hanford and the Bomb, 115; MacGregor, "I Was at Hanford," 35, 61, 29-31.

44. FTM, Oct. 16, Nov. 1, 1943; J. A. Ricker, "Memorandum for the File: Village - Villagers, Inc. - Experience to July 1, 1945," July 10, 1945, Richland, Wa., E.I. du Pont de Nemours & Co., Inc., "Memoranda for the File; Village Operation, Part I, Hanford Engineer Works, Richland, Washington" (Richland, 1945; cited hereafter as DP-VO), I:1-2; MacGregor, "I Was at Hanford," 2. The first three, July 1943, issues of the Sage Sentinel (which did not have a name yet) can be found in MRCF-DF, Box 9.

45. FTM, Nov. 20, 29, Dec. 9, 22, 1943.

46. FTM, Dec. 18, 1943, May 4, June 23, 1944.

47. FTM, Feb. 18, April 25, June 6, 1944.

48. HEWMR, March 1945, p. 7 (1st qtn.); du Pont, "Construction, Hanford Engineer Works," I:43; MacGregor, "I Was at Hanford," 5 (2nd qtn.); FTM, Sept. 4, 1944, March 8 (last qtn.), May 4, 1945.

49. Hewlett and Anderson, The New World, 110-112; Smyth, Atomic Energy, 98.

50. R.K. Whalen, "History of the 100-B Area," October 1989, PRR, #WHC-EP-0273.

51. Ibid., 3.

52. Valente, "Daily Diary," Aug. 29, 1944.

53. Smyth, Atomic Energy, 146-47; Crawford Greenewalt Diary, 1942-1944, Hagley Library and Archives, Wilmington, Delaware.

54. The xenon poisoning episode is explained by Hewlett and Anderson, The New World, 304-308.

55. Richard G. Hewlett, "Beginnings of Development in Nuclear Technology," Technology and Culture 17 (1976): 465-78; Hounshell, "Du Pont and the Management of Large-Scale Research and Development," 245-54.

56. "Two Farmer samples...were shipped this date to Site C..." Valente engineering diaries, entry for 17 July 1945, MED 1001, PRR.

57. Valente engineering diaries, entries for 4 Feb. 1945 ("100-B Area", MED 1002), 28 March 1945 ("100F Area Pre-start Up logs, MED 1003), and 4 July 1945 ("200 Area Diary," 1004), all in PRR.

58. Valente engineering diaries, entries for 5 July 1945 (on discharge from the D pile) and 12 July 1945 (on discharge from the B pile), MED 1001, acc. no. 10188 PRR.

59. MacGregor, "I Was at Hanford," 70. See also the comments of Warren E. Nyer in Sanger, Hanford and the Bomb, 134.

One indication of the changeover from construction to production was the decline in the incidence of venereal disease. As late as October 1944, the Hanford Engineer Works had a higher incidence of venereal disease than the Clinton Engineer Works in Tennessee, even though venereal disease, as a rule, was more prevalent among populations from the South and among populations of African Americans--two traits that "favored" Oak Ridge. By August of 1945, however, trends had reversed dramatically. Employees at CEW reported 499 cases of V.D. (all among civilian personnel), while employees at HEW reported 12 (8 among civilians). Without the construction camp, conditions at Hanford had changed markedly. See Stafford L. Warren to Leslie R. Groves, Oct. 20, 1944, and John L. Ferry to District Engineer, Oak Ridge, Sept. 12, 1945, MEDPR, Box 55.

60. MacGregor, "I Was at Hanford," 70.

61. MacGregor, "I Was at Hanford," 15.

62. FTM, Jan. 19, 1944.

63. Deutschmann, "Federal City," 22, 22n.2.

64. "D.S.M. Chronology," Oct. 17, 1942, MEDPR, Box 181; Nichols, Road to Trinity, 59; FTM, April 21 (1st qtn.), March 2, 1943; Mary Day Winn, "Out of this World," article MS for SSR, January 20, 1946, in RPL-R-History File, 4 (2nd qtn.).

65. FTM, March 2, May 21, June 23, 1943.

66. Roger Williams to Lt. Col. K.D. Nichols, April 29, 1943, MRCF-DF, Box 9.

67. G. C. Houston, "Memorandum for the File, Village - Administrative Organization and Control to July 1, 1945," July 23, 1945, Richland, WA, in DP-VO, I:1.

68. FTM, April 16, June 10, 24, 28, July 23, 1943.

69. Deutschmann, "Federal City," 112-14; M. T. Binns, G. C. Houston, T. B. Mitchell, and H. B. Price, "Memorandum for the File: Village - Housing Experience to July 1, 1945," August 3, 1945, Richland, WA, in DP-VO, I:9.

70. Nichols, Road to Trinity, 59.

71. Pehrson, "Report on the Hanford Engineer Works Village," 27, 42. This report also contains descriptions of the early home models.

72. FTM, March 2, Sept. 7, 1943.

73. Robert Jungk, Brighter than a Thousand Suns: A Personal History of Atomic Scientists, trans. James Cleugh (New York, 1958), 116; FTM, Dec. 20, 1944.

74. "G.E. Moves Into Hanford," Business Week (August 31, 1946):18.

75. M.T. Binns, G. C. Houston, T. B. Mitchell, and H. B. Price, "Memorandum for the File: Village - Housing Expansion to July 1, 1945," August 3, 1945, Richland, WA, in DP-VO, I:3-4.

76. Ricker, "Memorandum for the File: Village - Villagers, Inc. - Experience to July 1, 1945," 2.

77. Binns et al., "Memorandum for the File: Village - Housing Experience to July 1, 1945," 4-6, 9-10, 12.

78. Ricker, "Memorandum for the File: Village - Villagers, Inc. - Experience to July 1, 1945," 3-4; du Pont, "Monthly Report--February 1944," MEDPR, Box 182; FTM, March 9, 1944.

79. Villager, Sept. 3, 1945; TCH, March 24, 1989; William L. Laurence, Dawn Over Zero: The Story of the Atomic Bomb (New York, 1946), 132; Winn, "Out of this World," 2. Very few African Americans were employed in operations, and those who were hired worked primarily as laborers and therefore lived outside of Richland. FTM, April 11, 1945.

80. Ricker, "Memorandum for the File: Village - Villagers, Inc. - Experience to July 1, 1945," 2-3.

81. These figures come from about fourteen months after the war, when the Manhattan Engineer District counted more than fifty social organizations or clubs, thirteen churches, and six PTA groups at Richland. The Boy Scouts (one social organization) had five troops and five cub backs; the Campfire Girls had five groups for older girls and nine nests of Bluebirds; and the Girl Scouts had sixteen troops. J.W. Van Hoy to District Engineer, Oak Ridge, October 31, 1946, MRCF-ACC, Box 43.

82. G. C. Houston, "Memorandum for the File: Village - Administrative Organization and Control to July 1, 1945," July 23, 1945, Richland, Wa., in DP-VO, I:4; FTM, Sept. 11, Oct. 18, 1944.

83. W.O. Simon to J.N. Tilley, Sept. 13, 1944, and F.T. Matthias to K.D. Nichols, Sept. 18, 1944, in MRCF-DF, Box 9.

84. FTM, Oct. 23-28, 1944.

85. Binns et al., "Memorandum for the File: Village - Housing Experience to July 1, 1945," I:1-3, 12-14; C. Henningson and G. C. Houston, "Memorandum for the File: Village - Operating

Expenditures and Revenue to July 1, 1945," August 1, 1945, Richland, Wa., in DP-VO, I:1; F.T. Matthias to District Engineer, Oak Ridge, June 8, 1945, "HEW--Diary, Jan-45 thry [sic] June 45, Book 2," MEDPR, Box 25.

86. C. F. Barnes and J. A. Ricker, "Memorandum for the File: Richland Village - Schools - Experience to July 1, 1945," July 21, 1945, Richland, Wa., in DP-VO, I:1-2, 10-11; HEWMR, 5/44, p. 28. The quotation from early thinking regarding female employment comes from Williams to Nichols, April 29, 1943. On the capabilities of the eight women " 'chemists' " employed in operations supporting the D reactor, see Valente engineering diaries, entry for 13 March 1945, MED 1003, PRR.

87. Arsdol, Hanford...The Big Secret, 27; MacGregor, "I Was at Hanford," 15, 20-21.

88. Sanger, Hanford and the Bomb, 129; Henningson and Houston, "Memorandum for the File: Village - Operating Expenditures and Revenue to July 1, 1945," 3; FTM, March 26, Nov. 21, 23, 1944; HEWMR, 2/46, p. 70.

89. J. S. McMahon, "Memorandum for the File: Village - Disposition of Original Facility Buildings," July 21, 1945, Richland, WA, in DP-VO, I:1-2; FTM, Dec. 22, 1944.

90. Valente 200-area engineering diaries, entry for 27 November 1945 (p. 179), acc. no. 45761, PRR. What officials knew about wartime airborne wastes, and when they knew it, is the subject of Daniel Grossman, "Hanford and Its Early Atmospheric Releases," Pacific Northwest Quarterly 85 (Jan. 1994): 6-14.

91. FTM, April 23, Sept. 20, 1943, March 1, 1944; "D.S.M. Chronology," Jan. 23, 1943, Nov. 10, 1942, MEDPR, Box 181. See also Daniel Grossman, "Plutonium Production and Public Health: Work in Progress," paper delivered at Atomic West conference, University of Washington, Sept. 25-27, 1992.

U.S. Atomic Energy Commission, "Report of the Safety and Industrial Health Advisory Board," 10, mentioned dust storms and radioactivity.

92. Barton C. Hacker, The Dragon's Tail: Radiation Safety in The Manhattan Project, 1942-1946 (Berkeley, 1987), 45-65, and passim.

93. Gerber, On the Home Front, 77-86.

94. On winds, see Daniel Grossman, "Hanford and Its Early Radioactive Atmospheric Releases," Pacific Northwest Quarterly 85 (Jan. 1994): 11-12 for quotation; and Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Summary: Radiation Dose Estimates from Hanford Radioactive Material Releases to the Air and the Columbia River (n.p., April 21, 1994), 9, 16. On growing concern about iodine-131, see H.M.

Parker, "Some Considerations on the Habitability of the Hanford Camp Site," November 19, 1946, PRR, HW-7-5372.

95. U.S. Army Corps of Engineers, "Manhattan District History," Book I, "General," Volume 7, "Medical Program, First Edition," Dec. 31, 1946, p. 3.47, MEDRP, Box 161. See also Grossman, "Hanford and Its Early Radioactive Atmospheric Releases," 12-14.
Smyth, Atomic Energy, made a similar statement, but it was challenged by the U.S. Atomic Energy Commission, "Report of the Safety and Industrial Health Advisory Board."

96. Denham, Mart, and Woodruff, Notes from Key Former Employees, 3-5, 7; Eliot Marshall, "Hanford's Radioactive Tumbleweed" Science 236 (June 26, 1987):1616-1617; FTM, July 12, 1944.

97. Sanger, Hanford and the Bomb, 125, 156; Denham, Mart, and Woodruff, Notes from Key Former Employees, 3-5; AEC, "Report of the Safety and Industrial Health Advisory Board" (Washington, D. C., 1948; AEC-10266), 67; Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Summary, 11.

98. Sanger, Hanford and the Bomb, 159; FTM Feb. 2, 26, May 5, 9, 18, June 8, 10, July 30, 1945. On the nature and implications of the "speed-up," see Stanley Goldberg, talk to Atomic West conference, University of Washington, Sept. 26, 1992.

99. FTM, Aug. 13, 14, 1945; HEWMR, 8/45, p. 59.

100. Parker cited in TCH clipping dated August 6, 1965, located in "Hanford Works" file, Eells Northwest Room, Penrose Library, Whitman College, Walla Walla, WA.

101. FTM, Aug. 6-17, 1945; Sanger, Hanford and the Bomb, 55; Laurence, Dawn Over Zero, 163. The $350 million spent on Hanford was part of the $2.2 billion total for the Manhattan Project.

102. FTM, Aug. 7, 14, Sept. 3, 1945; HEWMR, 8/45, p. 85.

103. Mrs. J.W. Nichols to Col. F.T. Matthias, Aug. 17, 1945, MED-C, Box 80.

104. R.E. Dunning to D.H. Kennedy, Oct. 3, 1945, MRCF-DF, Box 90; "Plan for Transfer of Responsibilities and Functions of the Manhatten District to the Atomic Energy Commission," Nov. 1946, p. 3, MEDPR, Box 181; Asher A. White, "Census Tabulation of Richland, Washington," June 26, 1945, MRCF-DF, Box 8; G. C. Houston, "Memorandum for the File: Village Administration Experience - July through December 1945," DP-VO, I (Richland, April 24, 1946), 2, 20; G. C. Houston, "Memorandum for the File: Village Administration Experience - January through August 1946," DP-VO, I (Richland, September 10, 1946), 21, Supplement 9; HEWMR,

Oct. 1946, p. 106; Gerber, On the Home Front, 36; HEWMR, 9/45, p. 3; FTM, Aug. 24, Sept. 11, 1945.

105. Gerber, On the Home Front, 36; Deutschmann, "Federal City," ch. 3; "Plan for Transfer of Responsibilities and Functions," A-10.
Whalen, "History of 100-B Area," 35, gives the date of April 3, 1946 for B reactor's temporary closure; D.L. DeNeal, "Historical Events--Reactors and Fuels Fabrication," RL-REA-2247, July 1, 1965, p. 5, gives the date as March 19, 1946.

106. Hounshell, Science and Corporate Strategy, 339, 342-45; R.M. Evans to K.D. Nichols, Jan. 16, 1946, MRCF-DF, Box 96. In the early 1950s du Pont agreed to design, build, and operate the Savannah River plant in South Carolina. Again, wartime pressures--this time from the Korean and cold wars--seemed to influence its decision.

107. Nichols, Road to Trinity, 231; Hounshell, Science and Corporate Strategy, 244.

108. Hewlett and Anderson, The New World, chs. 13, 14; Daniel J. Kevles, The Physicists (New York, 1977), chs. 21, 22.

CHAPTER TWO

Life on the Production Frontier: Hanford and the Tri-Cities, 1947-1958

The history of Hanford and the Tri-Cities since 1943 has been a pattern of booms and busts, of confidence in and doubt over the future. The first phase of uncertainty lasted from mid-1945 to early 1947. Takeover by the AEC had indicated the government's continuing interest in plutonium production for military purposes, but nobody really knew at what level the Hanford Works (HW), as the plant was newly renamed, would continue to operate. Then, with the dramatic escalation of tensions between the Soviet Union and the United States during 1947, the AEC urged intensified production and accelerated construction of new plant facilities at Hanford in order to multiply the plant's output. Its efforts culminated in the appointment of Carleton Shugg as manager at Hanford on Labor Day of 1947, who, within two days, demanded from GE immediate overtime work on a construction project. With the addition of new reactors at Hanford, and the expansion of the village of Richland, people realized that, in the words of health physicist Herbert M. Parker, "the Hanford Works [now] has a long term future." The townspeople of Richland celebrated a similar sentiment with the theme of their Richland Day program of 1947: "We're here to stay!"[1]

* * *

The rapid growth at Hanford, which provided an enlarged sense of permanency in the Tri-Cities, defined the site's mission even more forcefully than before as industrial production. When the Atomic Energy Commission took over responsibility for the Manhattan District's research and production facilities, it ratified the division established during the war under the Army's direction. It seemed plain that America's nuclear program would be naturally divided between research and design centers, and centers for the production of basic materials, and that research centers were essentially academic sites while production centers were industrial in nature. Thus, Los Alamos, Argonne, and the new Brookhaven site were managed by universities, while Hanford (under the direction of General Electric) and Oak Ridge were managed by industrial concerns. The AEC even ratified the separation of the Sandia Laboratories from Los Alamos, determined that its central functions were more weapons engineering than research and development, and provided an industrial contractor, AT&T, to manage it.[2] Hanford's postwar activities would be shaped in part by its position firmly on one side of the divide between science and industry.

In the immediate postwar period, the effort to expand Hanford's production capabilities looked and felt somewhat like the wartime years at Hanford. The resemblance resulted in part from the sudden emergence of another global conflict, this time a cold war. The Truman administration made rapid production of more atomic weapons one of the nation's top priorities. As AEC chairman David Lilienthal explained, the agency needed to arm

"this country atomically, to erect a giant deterrent to aggression in the world." This deterrent would succeed, he continued, only if it was massive enough. The nation had to understand "that numbers are crucial in providing a deterrent to aggression: that high level of production and quality could provide what a dwindling monopoly has lost us."[3]

The need to manufacture a large number of weapons quickly placed much of the burden of production directly upon the Hanford Works, the sole supplier of fissionable plutonium for atomic bombs until the completion of the first reactors at Savannah River, South Carolina, in 1953. The size of the nation's stockpile was thus limited in large part by the pace at which HW produced plutonium, and prior to 1947 that pace had been rather slow.[4] With the decision to expand the stockpile, it became critical to increase production. That meant expanding the plant at Hanford, and doing so as rapidly as possible. Thus began a frantic race to build new reactors and speed up production in the old reactors.

It would be convenient to date the beginning of this race to March 1947, when the Truman Doctrine was announced. In fact, however, Hanford's spurt of growth had begun by at least November, 1946. In that month Richland had a housing shortage once again, because General Electric had begun to hire more people. Furthermore, it proposed to increase the Hanford workforce quickly, adding 150 by December 1, 267 more by January 1, 377 more by February 1, 452 by March 1, and so on. The lack of adequate homes in Richland became increasingly acute. By

April there was an "enormous backlog of instrument work to be done," J.E. Travis of the AEC reported. "Competent workmen...cannot be obtained in sufficient numbers for lack of housing on the project." Later that month, HW reported a shortage of 212 houses. At this point, Travis requested authorization to build another five hundred units. Three weeks later, he expressed a need for still another thousand.[5] The second great Hanford boom was under way.

Between 1947 and 1953, the AEC decided to add five new reactors at Hanford, and it completed them between 1949 and 1955. It simultaneously boosted the output of the older three reactors by three times. Such expansion required an enormous amount of resources. The initial burst of new building, between 1947 and 1949, amounted to the largest federal peacetime construction project ever for its time, and it increased the size of the workforce dramatically. Hanford had had 4,479 operations employees and 141 construction employees in 1946. Within two years, those figures jumped to 8,628 and 14,671, respectively. Between 1950 and 1955, the average number of operations employees at HW stood at 8,770, and the average number of construction workers hovered around 5,555.[6] Increasing employment in and around the plant naturally led to population increases at Richland. The village grew from 14,000 people in early 1947 to almost 22,000 by 1950.[7] But the village could not contain all the newcomers. GE and the AEC erected another construction camp between the town and the plant, called North Richland, which attained a maximum population of 13,000 in 1948.[8] People from

both the construction and the operating workforces also moved into such neighboring towns as Kennewick and Pasco.

Hanford's mission for the nation became clearer as it expanded. As one AEC spokesman termed it, Hanford represented "the production front."[9] This phrase suggested, among other things, the urgency that characterized the site in the late 1940s and 1950s. The plant underwent rapid remobilization so that it could help fortify the United States for the Cold War. Yet Hanford's special contribution to the fight was not research or strategy or training or assembly, but production--the manufacture of as much fissionable material for bombs, as quickly and cost-efficiently as possible. And, although maximizing production required continual innovations by scientists and engineers, over time the activities at Hanford became steadily more routine. As early as 1947, the AEC determined that at Hanford it needed "men of broad training and experience along engineering and scientific lines," and not "specialists." Each new reactor required the presence of specialists during startup, but as the years passed industrial operators rather than technical experts played the largest roles. By 1957 one observer explained that "the work force is comparable to that of any normal chemical plant."[10]

And like the work force at other chemical plants, that at Hanford was unionized eventually. Unions were not entirely new at Hanford. During both the Second World War and the post-war expansion, the government worked with organized construction labor. It recognized in 1947, as it negotiated in Spokane for an overall "construction agreement with the AFL Building and

Construction Trades Unions," that it had to conform to regional precedents and expectations in the "highly unionized West Coast and particularly the Pacific Northwest." The resulting agreement produced "very definitely a union shop."[11] One issue discussed was reimbursement for travel, which the AEC did not wish to pay. The union had noted that key employees working on more remote parts of the Hanford reservation were paid a higher wage than others of similar rank, and assumed they were receiving a travel allowance. In fact, GE was paying skilled (but not unskilled) labor a bonus "for hazards," because the most remote part of the site where they worked included the operating piles.

> While this could not be explained to the unions directly, it was pointed out that the work for certain craftsmen, in what happened to be a more remote area, received a differential for very much the same reasons that carpenters receive a differential for handling creosote.[12]

Because of the need for secrecy, labor relations at Hanford were seldom routine.

While unions had been a factor in construction at Hanford since the start of the project, they only gained a foothold among the operating employees in early 1949. Initially, organized labor had agreed with the Secretary of War that "no recognized unions existed at Hanford Works," but on September 27, 1948 the AEC "announced it would not now object to recognition of unions." The American Metal Trades Council of the American Federation of Labor petitioned for an NLRB-sponsored election, and on February

8 and 9, 1949, won certification as the collective bargaining agent for numerous plant employees. Thereafter, the Hanford Atomic Metals Trade Council (HAMTC) would negotiate with GE, but the AEC had already laid down several conditions to govern labor relations. The commission had to approve "all reimbursable expenses including wage and salary rates, premium payments and employee benefit plans of all types." It also stipulated that wages would be set and changed in accordance with those paid for similar work by other major employers in Washington state and the Portland, Oregon, metropolitan area. Finally, both unions and management had to assist the AEC in upholding its security requirements.[13]

The unionization of operating employees reaffirmed Hanford's production-oriented mission, and thus helped to set it apart from some other AEC sites. David Lilienthal attested this distinctiveness in 1949 while explaining the erection of a new plutonium fabrication complex at HW:

> The activities for which this facility was designed had been carried on at Los Alamos, largely by scientists. For security reasons, and because it was unsound to continue operating a production line with scientists, a second facility of different design was desirable, which could be operated by production men.[14]

Hanford and Richland belonged to the production men and women, not the scientists, and the contractor grasped this orientation fully. In its monthly reports to the AEC, General Electric predominantly emphasized the growing efficiency of the

plant. In June 1949, for instance, the contractor told of quantities of metal produced; the improved quality (or concentration) of the final product; the higher operating efficiency and expanded nominal power of the reactors; a "new high record yield" of acceptable slugs canned; new construction completed on site; and, to ensure that such gains continued, a "9-Point Job Improvement Program." An enlarged plant, coupled with heightened efficiency at all parts of HW--fuels processing, production reactors, chemical separations, and plutonium fabrication--resulted in dramatic production increases and per-unit cost reductions throughout the post-war period.[15]

Hanford's postwar mission underwent two major periods of expansion: first with America's commitment to nuclear weapons as a central part of postwar defense doctrine, and then with the intensification of the Cold War in the years 1949 to 1953 and the outbreak of the Korean War. At the end of World War Two, Hanford's reactors and separation facilities, which had been built in a wartime crash program, were assessed as resources for long-term production. In ensuing years, the wartime reactors (B, F, and D) were improved to extend their life and increase their output; a second generation of reactors on the same basic pattern was added to the site (DR, H, and C); and finally two "jumbo" reactors came on line (KE and KW). All of these were graphite-moderated piles, and their improvements were variations on the basic theme rather than new technologies. Changes, then, were basically incremental rather than fundamental. Two new processing facilities, Redox and Purex, were built as well.

The pattern of incremental change began with concerns over keeping the wartime reactors in operation. Under intense neutron bombardment, the graphite blocks in B, D, and F reactors began to grow, undergoing "graphite creep," or the "Wigner effect." This problem threatened reactor operations. Also, with increasing demand for plutonium and other weapons components, GE and AEC had to face the question of how to maximize a reactor's output, a problem which involved balancing the possible increase in reactor power levels, the efficient use of uranium fuel, questions of reactor safety standards, and corresponding increases in environmental contamination.

Graphite creep and ruptured fuel elements--the latter, events in which cans of uranium fuel bulged or burst under the strain of heat and radiation, jamming the process tubes which also carried cooling water--were problems which threatened to make reactors obsolete. Graphite creep was held under control in the older reactors by increasing the temperature in the pile; this was achieved by running at higher power and also by replacing the helium atmosphere which surrounded the reactor with a greater concentration of carbon dioxide, a less heat-conductive gas. (These matters are explained in greater detail below in Chapter Three.) Hanford's staff sought to deal with the problem of fuel element ruptures by shortening the lengths of the cans from eight inches to four inches, making them less likely to jam in the process tubes, and also by forging the uranium powder into cylindrical elements in such a way that the crystal structure throughout was anisotropically oriented.[16]

Construction of the earliest postwar reactors, DR, H, and C, presented an opportunity for the exploration of new designs. But given the urgent demand for fuel, the new reactors followed the pattern that would allow them to be built quickly and with the greatest degree of certainty. They were essentially modeled after the wartime reactors, as indicated by the designator for the first one built. "DR," which stood for "D-replacement," was built to make use of the power and cooling systems already in place for D reactor, should it wear out. Reactor development was centered elsewhere, while Hanford focused its efforts on reliable production. Especially as the problems of graphite creep and fuel element jamming seemed to be brought under control by fairly simple means, there appeared to be no reason to mount a major developmental effort at Hanford with a view to changing the basic pattern of reactor technology.

Incremental improvements in the basic components of the World War Two reactors, and a construction program to build reactors which incorporated these changes, accounted for a doubling in plutonium output over 1952 and 1953, as Hanford answered the demands of a dangerous world situation and a vigorous design and testing program on the part of Los Alamos and the new design center at Lawrence-Livermore. New plutonium extraction centers, Redox, Purex, and Recuplex, were built to process this output. The last reactors built on the wartime pattern, albeit at an enlarged size, were the "Jumbos," also designated KE and KW. They followed a well-established pattern and exploited well-known techniques, although they ran at much

higher power. If anything, Hanford took a step backwards, as the AEC began to be concerned about GE's ability to handle large construction projects. In the Jumbos, specially selected graphite, the expansion qualities of which were believed to be well-known, was put into the pile to head off graphite creep ahead of time.

Thus, through the period of maximum danger in the Cold War, the AEC mandated that Hanford favor certain operations over research, and plutonium production over power production. This policy was endorsed by the General Advisory Committee (legally mandated to offer scientific advice on AEC policy), by the Commission's staff in its Production Division and the Division of Reactor Development, by the Military Advisory Committee, and by the congressional Joint Committee on Atomic Energy.

Also, throughout this period, Hanford's staff and the AEC demonstrated a clear understanding that increased production exacted a cost in terms of environmental contamination. Their waste disposal policies for low-level contaminants rested on diluting them in the air, water, or the landscape near the separation plants. Throughout the period, production rates were limited to decrease the rate at which contaminants were introduced into the environment. On the other hand, a certain level of contamination was accepted by the AEC and Hanford's management as an acceptable cost of producing materials for use in nuclear weapons. Calculations of exactly what that cost would be, in terms of the effects of Hanford's releases off the site, continued as more and more plants went into production.[17]

The drive to increase production and reduce expenses--a formula that prevailed at the site through the mid-1980s--took precedence over virtually all other considerations. GE had been selected as an AEC contractor in large part because of its interest in the commercial dimensions of atomic energy, and it had hoped to gain experience at Hanford with new reactor designs. But in the rush to generate more plutonium, and in the selection of other AEC sites for newer reactors, GE found little chance to develop expertise with different types of piles at Hanford.[18]

The AEC's primary objective in the early 1950s, explained the General Manager, was "providing new productive capacity at the earliest possible date and at the lowest reasonable cost."[19] This formula of maximizing production of plutonium and minimizing the cost summarized a prevailing orientation at Hanford from the early 1940s through the mid-1980s.[20] The need to increase the efficiency of operations took precedence over other considerations. This is not to say that the AEC tried to cut costs at Hanford in every way. It recognized the need, for example, to recruit and retain the right personnel for the job, and spent accordingly. Similarly, it developed a comparatively elaborate system of environmental monitoring, even though it did not release the results of its monitoring studies to the public. But on the whole the mission of Hanford was to maximize the production of plutonium. Environmental and safety considerations were secondary.

During the late 1940s and the 1950s, the AEC bypassed numerous opportunities to tighten safety precautions at HW

because it concerned itself above all else with production. For example, from the late 1940s until the early 1960s the AEC's Advisory Committee on Reactor Safeguards raised questions about the lack of containment buildings around the eight Hanford reactors. Without some kind of enclosure, any severe accident at the plant was considerably more likely to present serious threats to downwind populations as far away as Spokane. Yet, when Edward J. Bloch, the AEC Director of Production, weighed the value of installing certain new safeguards against the prospective costs, he opposed spending the extra time and money to make the plants safer: "The contribution to national security through gains in plutonium-production...appear to outweigh the...consequences... [of] the unlikely event of a major reactor accident."[21]

It is within this overriding mission of production that the evolution of the town of Richland between 1947 and 1958 must be understood. As long as the AEC owned and operated the village, it regarded the town primarily as a tool with which to increase the production of plutonium. In this regard, Richland differed little from Oak Ridge and Los Alamos, as AEC Chairman Gordon Dean explained in 1950: "the AEC communities exist solely and completely for the support of the atomic energy plants and laboratories in or adjacent to the communities." Furthermore, the AEC could allow no disruptions in its towns that might have a negative impact on its programs.[22]

Richland's status as the "bedroom of the plant" was understood by all concerned. Residents of the community appreciated, and even took pride in, its unique status.[23] GE's

grasp of the issue became clear when the contractor had to defend itself against charges of mismanagement. During the rapid expansion of the late 1940s, the company experienced substantial cost overruns which became the subject of a Congressional hearing. One of the overruns occurred on the new plutonium fabrication facility at the plant; another occurred on a new school building in town. These two instances call to mind the pace of building during World War Two, because construction started on each project before designers had actually completed the plans, and this inevitably drove up its costs. In both cases, GE explained the excessive expenditures as the direct result of the urgency that characterized the drive to increase production at Hanford. Of the cost overrun in town, one GE spokesman said, "this school building, while no plutonium is produced in it, nevertheless is a part of the whole facility which looks toward the maintaining of satisfactory output of the plant."[24] By suggesting that town facilities were just as important to production as plant facilities, GE reiterated the sense of Richland as a cog in the manufacturing machinery of the Hanford Works.

While the AEC and its contractors accepted the necessity and the responsibility of operating communities, they were not altogether happy about the situation. As the Congressional inquiry into cost overruns at Richland indicated, the towns made good targets for critics. Investigators and regulators, including members of the JCAE, who knew little about science or technology, often zeroed in on AEC towns because they felt more

competent to criticize in that area.[25] And many of the criticisms doubtless had some validity. GE may have possessed the business, engineering, and scientific expertise needed for producing plutonium, but perhaps it lacked the experience needed to build and operate a town of 20-30,000 people.

AEC rhetoric made it seem as if the Commission were not really prepared to run the communities, either. Carroll Wilson, General Manager of the AEC, pointed out that his agency "was not in the business of operating towns because we like to." It had not itself chosen or built Oak Ridge, Los Alamos, or Hanford, but had rather "inherited" them from the Army "along with the rest of the operation." And Commissioner Dean claimed in 1950, with some hyperbole, that the AEC towns had generated "the largest number of headaches for us." The AEC found it awkward to be in the business of operating towns, in part because government-run communities smacked too much of socialism and so made the commission more vulnerable to political criticism. Thus it is no wonder that the AEC, when it built new facilities in Idaho and South Carolina during the late 1940s and early 1950s, explicitly located its operations where existing communities, lying outside of federal reservations, could absorb the new influx of workers, obviating the need for the commission to build additional towns.[26] It is also no wonder that, as early as 1947, the AEC began considering how it could best divest itself of its towns. Yet as later events showed (see Chapter Four), the Commission and its contractors never made haste to unburden themselves of the

towns, largely because doing so might endanger with the greater goal of accelerating and maximizing the production of plutonium.

In setting out policies for its communities in 1947, the AEC established a list of objectives. Its first priority was to manage towns so as to enhance their ability to recruit and retain needed personnel. Its second priority was to keep expenses as low as possible, provided that cost-cutting measures did not injure the towns' ability to keep residents content. Its third priority was to find a way to dispose of the towns without affecting the efficiency of AEC programs.[27] The first two objectives were short-term goals; the last required decades to realize. (AEC efforts to dispose of Richland are treated in Chapter Four.)

Making Richland attractive enough to help recruit and retain plant employees entailed the development of "an above-average community."[28] Richland needed better homes, good schools, and ample services for its residents. And without any tax base of its own--because the federal government owned all property--the AEC had to pay for all the amenities the town required. The commission attempted to keep the level of subsidy as low as possible, but it refused to go below a certain minimum because it believed such cutbacks would jeopardize the efficiency of its production program. For example, the AEC justified its support for an inefficient bus system for the town by calling public transit "as much a tool of the manufacture of the plutonium as the atomic piles themselves." Funds spent on Richland, the AEC

explained, "represent expenditures made as a means of getting the atomic energy job done."[29]

Besides providing a comfortable community in which to live, the AEC determined that it needed to ensure that its tenants lived in towns that seemed as "normal" as possible. In late 1947 the commission instructed its contractors that, "consistent with security and other requirements, residents at field installations shall enjoy those facilities, services, and activities which are properly a part of American community life." The government was especially eager to see that townspeople had an opportunity at self-government. The AEC expected its contractors at Oak Ridge and Richland to consult residents when making decisions affecting the towns, and to develop some elective body of citizens which would express townspeople's opinions regarding community management. This requirement sometimes proved troublesome for the AEC, and especially its contractors, who found that the community had numerous complaints and suggestions about operation of the villages. Nonetheless, over the long term it worked to the commission's benefit, for at least two reasons in particular. First, participation in community politics was another amenity that helped recruit and retain employees.[30] Second, by encouraging the development of self-government, the AEC was preparing its communities to become self-sufficient towns that no longer needed government subsidy or contractor management.

While the AEC laid out general guidelines for community operations, its contractors had the direct responsibility for managing towns on a daily basis. To operate Oak Ridge, the AEC

hired Management Services, Inc., a non-profit company that worked under a contract separate from plant operations. At HW, the AEC hired General Electric both to operate the plant and to manage the town.[31] Thus GE assumed responsibility for all the tasks associated with housing employees and their families, attracting and regulating businesses, and providing all the municipal services expected in an above-average community--all of this, of course, under the watchful eye of the AEC.

Operating Richland frequently placed GE in an awkward position. Although the company was supposed to make the town as "normal" as possible, there was no way to hide the village's exceptional character. The town's subservience to the imperatives of production at the plant, coupled with the overwhelming need for security, prevented Richland from resembling most other towns. Consequently, GE and the AEC became the target of a variety of complaints, especially around the late 1940s. Critics characterized local government as a "benevolent dictatorship" and depicted Richland as "completely a 'company town'...under the absolute and arbitrary control" of the AEC and GE. Businessmen in particular protested the interference of GE and the AEC in their operations.[32] Others likened the town to a "police state," with excessive surveillance of both residents and visitors, and criticized the use of GE employees--and not trained policemen--to patrol the village and enforce laws.[33] Although Richland, unlike Oak Ridge and Los Alamos, was located more than twenty miles from the main part of the production plant, it nonetheless shared much of the workplace's concern with security.

For its part, GE, recognizing an awkward situation, tried to put the best possible face on its community management policies. It conceded that Richland "had been operated in a somewhat autocratic fashion" during wartime by the Army and du Pont, but claimed that its own reign would cleave "as nearly to normal as it could be done." Thus in 1949 it removed all provisions from its leases with commercial tenants that specified how they should run their businesses. Furthermore, in recruiting new employees, GE assured people that "law enforcement is efficient, but there is no interference with any normal personal conduct. Richland is not a town within a stockade."[34] Lewis F. Huck, in charge of community planning for GE, perhaps best captured the contractor's delicate approach to the subject. He explained in 1951 that, although he did serve as planner for Richland, he worked to "give a measure of 'uncontrol'" in his activities in order to convey the impression that he and his company did not wish to run townspeople's lives too much.[35]

The problem with the image that GE tried to project, of course, was that until the residents could own their own homes, elect their own officials, and pay their own taxes, they had to go along with GE and the AEC. The company, not the citizens, ran the town, and it ran it on behalf of the AEC. The commission required that the company consult the residents and listen to their grievances, but it ultimately had to report and justify all actions and expenses to the government, not to the townspeople.[36] This situation created some tensions, to be sure, but it did not consume the town.

Many of the differences between the community and GE were aired in the meetings of the Richland Community Council, which was established at the AEC's request in 1948 as a means for the contractor to consult with the people it governed. The council consisted of eight or nine members elected by the population. It held regular meetings which provided a forum for residents to raise questions or propose changes, but it served only as an advisory body, with no legislative power and only a minimal budget provided by GE. One or more representatives from GE and the AEC customarily attended council meetings, although apparently not always with enthusiasm. The company's general manager for HW characterized some councilmembers as "self-appointed champions of the people who are generally irresponsible." The council, for its part, occasionally tested the limits of the governmental structure. In May of 1954, without asking permission, the group changed its name from Richland Community Council to Richland City Council, even though the town would not incorporate for more than four years. Council president Fred Clagett explained, "Legally we like to blow our horn a little bit."[37]

At most of its regular meetings the council apparently performed its duties in a businesslike fashion. Its minutes make it seem vigilant but seldom too troublesome. It attempted to present the complaints of townspeople to GE and asked for answers, and possibly action, in return. For example, in August of 1952 it voiced citizens' protests against the dust and nighttime operations of the Curtis Sand and Gravel Company batch

plant, located west of the By-pass Highway. The GE company spokesman tried to persuade the councilmembers that the matter lay outside their jurisdiction, but they persisted anyway, pointing out that GE had instructed the company where to locate and that the company's operations affected the entire town.[38]

Many other complaints throughout the early and mid-1950s concerned housing policies, probably the greatest source of community-related "headaches" for GE and the AEC. When Hanford employees retired, they and their families lost the right to live in Richland; by the same token, employees whose spouses divorced them or died and whose dependents left them, had to give up their houses and move into dormitories with other singles. The council urged GE to make exceptions for retired, divorced, and widowed employees, but to no avail.[39] AEC policy rather inflexibly gave housing priority only to those who had a well-defined role in plutonium production at HW. Without the correct kind of tie to the plant, citizens would be evicted from their Richland homes. For many townspeople, this kind of vulnerability was the most troubling aspect of life in an otherwise "above-average" town.

Two rather extreme examples may serve to illustrate the problems presented by AEC housing policies. In June 1955 an electrician on the project wrote to Senator Warren G. Magnuson about an upcoming crisis. This individual had purchased property just north of the town in 1922, built a house, and operated a farm there until 1943 when his holdings were taken over by the Army. He went to work at Hanford, and consequently was allowed to rent his house back from the government. Meanwhile, he

continued to earn income on the side by raising chickens and selling eggs. But in 1955 he was reaching retirement age. Naturally, the electrician wanted to remain in the house, partly because he had built it and lived there so long, and partly because he wished to remain in the poultry business in order to supplement his retirement income. Senator Magnuson learned, however, that, according to AEC policy, his constituent would be required to move out of a dwelling he had occupied for thirty-three years.[40]

The following year, a Benton County sheriff's deputy wrote to Senator Henry M. Jackson, asking him to intervene in another housing matter. The deputy had recently married and moved into his spouse's house. The wife had worked at Hanford for GE for a year before her marriage, and consequently had been able to rent a Richland home. The deputy was pleased to reside in Richland because the sheriff, trying to disperse his deputies throughout the county, had instructed him to live there. Shortly after the couple started keeping house together, however, GE informed them that they would have to leave their quarters. Because the woman had gotten married, the company no longer considered her the head of a household. Her husband was the head of the household, according to AEC policy, and he was not "project-connected." Therefore, the couple lost the right to live in the wife's Richland house. On behalf of the couple, Jackson appealed to the AEC, but the Commission would not yield. It defended its policy and carried out the eviction.[41]

Problems such as these plagued GE and the AEC as they tried to run the town, and also took up a great deal of time before the Richland Community Council. Housing was a particularly sore subject, because AEC policies, designed to recruit and retain employees and also to forestall Congressional criticism, were especially rigid. In some other matters, GE made concessions to citizen requests, often after appealing first for permission or guidance from the AEC. But in many instances, including housing but also a number of other issues, GE could or would do nothing, although it was obligated by the AEC to try to explain its reasoning to the council. The situation presented frustrations to both sides, the contractor and the townspeople. Yet for a number of reasons these frustrations did not escalate into serious or lasting tensions.

For one thing, GE <u>did</u> change Richland government to make it more responsive to residents. And as citizen input into decision-making expanded over the years, it turned out that the citizens seldom reached the degree of consensus in their opinions that would lead to complete polarization between the company on one side and the council members all on the other. One of the reasons for this, admittedly, was that a number of townspeople were reluctant to voice complaints against community management. Most heads of household in Richland <u>worked</u> for GE, including many councilmembers, and these employees did not seem eager to challenge the company line. Some council members came from the ranks of GE management, and perhaps they had helped to establish the company line. Others on the council and in the town

undoubtedly feared the consequences of crossing the company. When residents wrote letters to the editor of the <u>Tri-City Herald</u> (TCH) in 1952 to complain about their lack of input into local government, they generally withheld their names from publication.[42]

Richland residents also generally acquiesced to the preferences of GE and the AEC if it meant yielding to the need for maximum production. In 1951 the community council reported the citizens' desire "to place the community on daylight savings time," but in the same breath conceded that if the plant stayed on standard time, the town would have to conform to HW. Nobody ever lost sight of Richland's place in the scheme of production. A council member pondering the implications of self-government summarized the widespread sentiment: "The atomic program is Number 1. If it takes leaving [the town] as it is, let's leave it; if we can have more and more self-government, OK."[43]

Finally, beginning in the early 1950s it became steadily clearer that town government by GE would not last for long. As the AEC worked toward disposal and incorporation of the community, townspeople worried less about control or mismanagement by the company and more about preparing themselves for self-government. And in this gradual process, as on other occasions, GE often sided with the townspeople and against one federal agency or another. The contractor particularly spoke up on the villagers' behalf when it believed that some proposed course of action by the government would interfere with plant production by disrupting the home life of employees.

One group that lacked much influence in town government was organized labor. Perhaps this was because Richland tended to house white-collar rather than blue-collar employees at Hanford. Few union members served on the town council, in part because it was too costly. While a number of GE's salaried employees served on the community council without loss of pay, "weekly" employees were not reimbursed for wages lost while attending council meetings.[44] The makeup of the advisory council generally mirrored Richland's disproportionately professional and managerial work force.

Even the mostly white-collar members of the advisory council, however, exerted little influence over certain key facets of town operations. Consider the realm of city planning. As part of managing the community, GE had to plan for "Village Expansion" to occur in "increments correlated to [the] plant expansion schedule."[45] To assist in this process, GE and the AEC contracted with the engineering firm of J. Gordon Turnbull, Inc., and the architectural firm of Graham, Anderson, Probst & White, Inc. (JGT, hereafter) to prepare a new master plan for the city. They instructed the planners to guide the growth of the town population from 15,000 to 25-35,000 by increases of 5,000 at a time. The final result, issued in 1948, was a rather lavish document aimed at shepherding the town toward a larger, more permanent, and more attractive existence. What was unusual about the Master Plan was that, unlike similar documents for most other towns, this one was actually adhered to fairly carefully. Richland had no politics-as-usual in which the ideas of designers

came to be opposed or diluted by different interest groups in the community. So GE had a fairly free hand to implement the master plan, and generally followed its guidelines.[46]

That the master plan was conceived and implemented without significant community input typified much about the nature of power in Richland before 1958. Planners did not generally ask citizens about their preferences for the town. They consulted instead with a "relatively small group" of AEC and GE officials. In delivering the final document, JGT urged the AEC and GE to explain the plan to the community, thereby educating citizens so they would appreciate its virtues and support its implementation. JGT also urged that residents serve on a proposed town planning commission--albeit merely in an advisory capacity. But note that the planners suggested that GE and the AEC only solicit the community's approval. No provision was made for getting residents' input before the plan was drafted; no provision was made for modifying the plan in the event that citizens objected to all or part of it. Furthermore, despite JGT's advice to solicit citizen support for the master plan, the managers of the community were not eager to publicize it. When journalists requested copies of the document in November 1949, they learned that it was not "advisable" to circulate the plan beyond officials from GE and the AEC.[47]

That the process of planning was neither very public nor open seems somewhat paradoxical, because planners aimed above all else--in accordance with AEC policy for managing communities--to help make Richland a more "normal" community. Acknowledging the

AEC's long-term goal of trying to release controls, reduce subsidies, and encourage self-government, JGT understood one fundamental purpose of its planning as shaping

> a home community, where...people may settle and follow normal patterns of living. The planning must provide adequate homes, shopping centers, schools, playgrounds and churches--all essential parts of the environment in which the worker and his family enjoy their livelihood and consume his income.

At the same time, however, JGT recognized that Richland residents comprised a highly select group, employed in a unique industry, and tried to redesign the town so as to minimize their turnover and maximize their productivity.[48] In other words, planners had to create a "normal" place to live for a group of abnormally select people so that they remained abnormally content and productive.

Normalizing Richland implied that, in the new village, order would replace chaos. The engineers, architects, and planners hired by GE made a point of criticizing what their predecessors had done during wartime as unsatisfactory for the post-war era. The emphasis then, they explained, had been on meeting a national emergency rather than addressing the long-term needs of a community.[49] The implication in this statement was that planners working in 1947 and 1948 could more patiently and carefully plot Richland's future. This assumption no doubt contained a kernel of truth, but it also glossed over the realities of the ongoing boom at Hanford. Like the reactors built during wartime, post-

war construction of the town of Richland would be long under way before the plans for it had been finalized.

The Army and the AEC had been rushing to increase production and enlarge Richland since November of 1946, a full two years before the JGT Master Plan appeared, and they had already approved of a number of changes for the town. Late in 1946, for example, they started a planting program in order to reduce dust storms. And by the spring of 1947 it had been decided that Richland's new housing stock, designed in part again by the office of Spokane architect G. Albin Pehrson, would feature safer, cleaner, larger basements; oil-fired furnaces rather than coal heating; porches where none had existed before; individual driveways instead of communal parking compounds; and concrete curbs and sidewalks for the first time. The village was, in effect, being planned without the benefit of master planning. In fact, in May of 1947 the AEC had specifically decided not to await the completion of an overall plan before continuing with its expansion effort. Given the urgency of increasing the production of plutonium, it could not afford to wait while planners studied the village. Furthermore, the "original layout" of the town and the ongoing building program had "determined fairly definitely [the] direction of proposed expansion."[50] J. Gordon Turnbull, Inc. and Graham, Anderson, Probst, & White, Inc. still had much to offer in the way of a master plan, but to a certain extent their document merely confirmed decisions already made and reinforced existing patterns.

One overall thrust of the post-war development of Richland was to create a more thoroughly middle-class village. Wishing to eliminate any vestige of a "company town," JGT viewed the need to double Richland's size as an opportunity to design a permanent, aesthetically pleasing, residential community. Emphasizing that Richland would become a city of homes for a relatively affluent and stable population of HW employees, planners supported the AEC's policy of shunting construction workers off to North Richland, the cluster of trailers, dormitories, and mess halls that would expand or shrink as circumstances required. Within Richland proper, they intended to increase the percentage of land devoted to single-family housing, commercial buildings, community services, and parks and playgrounds, while decreasing the proportion of industrial and vacant land.[51]

The result borrowed heavily from the ascendant suburban styles of the post-war era, as if suburbs represented "normalcy" for the middle-class population of Richland. The town became, for example, even more oriented than before around shopping districts and automobiles.[52] Yet Richland itself could not accurately be labeled a suburb. It was not adjacent to any larger city with a dominant central business district. Many of its employed residents did commute to work to the plant, but they still looked to Richland itself for administrative and civic centers, recreation, and cultural life. Indeed, one of the planners' duties was to help develop for the village enough of a town nucleus to keep residents content. Creating a new shopping district represented one key step toward this larger goal.

During wartime, du Pont had built the older "downtown" shopping area, adjacent to dormitories and plant administration buildings. This district contained too few shops and services as well as too many run-down buildings for the post-war community, however, and it offered virtually no room for expansion. The new master plan consequently laid out the new "uptown" shopping district, sufficiently more spacious and attractive than its predecessor to make downtown businessmen resentful. In addition, whereas the government contractor had built and leased structures in the old downtown, commercial tenants in the new district leased the land from GE and erected their own buildings. The first uptown stores and offices opened in 1949, providing some of the goods and services that an above-average hometown required.[53]

It seems doubtful that Richland, particularly before 1958, ever provided enough shops and services to satisfy the consuming desires of most residents. Some businessmen complained that, even after the opening of the new shopping area, many villagers continued to spend their sizeable disposable incomes "away from home." Perhaps this was because, under federal controls, there were too few stores and services to provide good selection or competition. In addition, the townspeople were almost all newcomers who, in all likelihood, lacked much sense of commitment to local merchants. They also enjoyed traveling. Council member Fred Clagett commented in 1955 on how frequently the "people of Richland...migrate to Portland, Seattle, or Spokane for weekends to do their shopping"--a practice that apparently continues in the 1990s. Yet local businessmen hardly suffered too much. Most

had an ideal market situation--few credit risks among local buyers, little unemployment for most of the late 1940s and 1950s, and minimal competition from other merchants.[54]

While planners wished to provide enough shops and services to satisfy the people of Richland, they had other motives as well for encouraging commerce. Understanding the long-term goal of eliminating federal subsidies for the town, they viewed stores and services as a source of local revenue that would, in the future, replace AEC funds in the municipal budget. However, to generate enough business in the village, people from Pasco, Kennewick, and other nearby towns and farms would have to be attracted to Richland merchants, and this would require better access. To this end, JGT argued against Richland's continued isolation by urging a better system of roads connecting the town to nearby communities. Furthermore, the master plan saw Richland's commercial future and fiscal self-sufficiency as dependent upon completion of the Columbia Basin Project. Cargo traffic along the Columbia River, industries attracted by cheap hydroelectric power, and increases in irrigated agriculture were all envisioned as essential ingredients in the town's economic maturation.[55] Already, the government had placed a premium upon economic diversification of Richland.

While planners attempted to redirect people's commercial relations with one another, they also tried to transform the community's relationship to the environment. Making Richland a pleasant place to live meant altering nature. The desert conditions of south central Washington heightened the need for

shady, green refuges in town during summer months, so the master plan called for an increase in parks and playgrounds.[56] It paid even more attention, however, to holding down the sandy topsoil in and around Richland, which regularly blew into dust storms when lifted by the area's strong and regular winds. Dust storms made the town uncomfortable, and threatened to drive away HW employees; perhaps even more importantly (although unknown to planners), the dust storms polluted the atmosphere and broadcast wastes from the plant by scattering "radioactive and toxic products" that had been generated during manufacture of plutonium. The master plan proposed as remedies the widescale irrigation and cultivation of unused lands in and around the village--one of the reasons that the town had a high rate of per-capita water use. It also called for the continuation of previous efforts to control dust by planting a "shelter belt" consisting of "five rows of shrubs and trees" along the southern and western boundaries of the town. Vulnerable to floods, drought, and high winds, the shade trees, shelter-belt plantings, and ground cover required continuous attention from GE throughout the 1950s.[57]

Other natural problems received continuous attention as well. GE sprayed chemicals to eradicate weeds from the Hanford areas and Richland village, including in particular the irrigation canals. It also sprayed DDT and burned marsh areas in order to eliminate mosquitos, set out poison bait for rodents in the 200 Area and in parts of Richland, and advised villagers to keep sagebrush out of their yards.[58] Again, these impulses to

control the environment and, to a certain extent, to "denature" Richland, may well have stemmed from the realization that certain plants and animals absorbed, concentrated, and transmitted radioactivity which had been released from plant operations.[59] Most residents, however, could not be permitted to know the reasons behind the almost obsessive attempts to control certain natural pests.

While proposing means for controlling the natural environment of Richland, planners and managers of the town also prepared the way for a new residential environment by planning for the expansion of housing. GE had inherited about thirty dormitories in the village, each of which consisted of between 38 and 50 rooms assigned to single adults, but dormitories did not correspond with the suburban image sought for Richland. Many of the homes built during the war were also now regarded as unsatisfactory. Duplexes seemed too small for the two families they had been built to house; pre-fabs seemed the least attractive units. Too much housing was simply too small or too cheaply made. The residents' constant, illicit remodeling of their homes provided one index of the widespread dissatisfaction and desire to improve the buildings. GE worried in its January, 1947 monthly report to the AEC that too many tenants were trying to increase their space by digging unauthorized basements that in some instances jeopardized the entire structure.[60]

The scramble to build new housing was well under way by the time the master plan was completed in November of 1948. Roughly 3850 houses survived the wartime era. The 1947 building program

added another 800 houses and 64 apartments, and the following year saw completion of still another 1,000 units. The newer houses were generally more attractive than the older ones, and many of them were "clustered in the fashionable areas close to the Columbia River." In mid-1948 JGT tabulated roughly 5,700 housing units existing and under construction, occupied by 23,592 people.[61] Richland was hardly a "village" any longer, a fact that was recognized in 1950 when the weekly newspaper, the Richland Villager, ceased publication and declared that the community needed a daily newspaper that suited better its growing urban status.[62]

By that year the number of housing units in town had increased to almost 6,000: 3,840 of these were single-family dwellings, including pre-fabs; another 933 were duplexes; 9 apartment buildings contained 74 units, and 30 dorms contained 1,150 beds.[63] The 1950 population had declined to about 21,800, and for the remainder of the 1950s it would hover between this figure and 23,450, the 1960 total. But for a variety of reasons a housing shortage persisted in Richland through the early 1950s, despite the stabilization of the population. (It was this shortage that guaranteed that the AEC and GE would remain inflexible in their housing policies.) Workers preferred dwelling in the town to living outside it, even though there were too few units to accommodate them all. In March of 1952, consequently, a waiting list for open housing contained 600 applicants. Also, over the decade GE phased out the dormitories, closing the last one down in mid-1958. By that year, however,

the housing picture had changed considerably. In 1950 the vacancy rate had stood at 1.41% and the average number of residents per unit was 3.86. By 1958 the vacancy rate had grown to 10.1% and the number of residents per unit had fallen to 3.63. Richland had fewer tenants in multiple-family dwellings, fewer pre-fab houses, and smaller families.[64]

Observers tended to praise the physical appearance of Richland during the 1950s. It seemed not to resemble a company town because it did not have a "housing project look." Rather, it looked like a "remarkably well planned community." It featured not only nice homes but also good schools, parks, churches, health services, and retail districts, with no slum areas and, by 1957, no overcrowding. Richland seemed to many people to be a "model" community, and the townspeople took increasing pride in that fact.[65]

The pride was not immediate. Betty and Melvin Jacobs were initially "disappointed" in Richland when they arrived in 1948 because it seemed raw and windy. Yet over time they came to like the town, especially because it had good facilities for raising children.[66] Just as Richland gradually appeared to be a model town in the physical sense, so its residents seemed to comprise a model community in the social and cultural sense. In fact, as population growth surged during the late 1940s and then leveled off during the 1950s, both the townspeople and outsiders commented frequently on its above-average demographic profile. Richland in 1946 was "a town of many children, of young people, of almost no deaths, a town where everybody had a job, a town

with a pleasant planned look about it."[67] Most of these characteristics persisted over the next decade and a half.

The distinguishing traits of the population stemmed mostly from the employment of the vast majority of the town's workforce at Hanford. The plant required people with certain skills and good educational backgrounds, screened them carefully for security and safety reasons before hiring them, and paid employees well. Both in 1950 and 1960, the adult population possessed, on average, more than 12.5 years of schooling. More than 40% of all males over 24 years of age in Richland in 1960 had attended college; the figure for Washington state was 22%.[68]

The higher level of schooling helps to explain the high proportion of "administrative, technical, and engineering personnel" residing in the town, which in turn helps to explain the relative affluence of the population. In 1959 the median family income for Richland was $8,368; for Washington, it was $6,225. The town's overall prosperity did not stem from the presence of a highly paid elite, and its population was not deeply stratified along socio-economic lines. Richland had neither a sizeable lower class nor much of an upper class, but rather consisted mostly of what one observer termed the "middle of the middle class." In 1950, 26% of all American families had annual incomes under $2,000, 53% had incomes between $2,000 and $5,000, and 21% had incomes over $5,000. In Richland, none (0%) of the families had incomes under $2,000; 87% had incomes between $2,000 and $5,000; and 13% had incomes over $5,000.[69] Noting the community's educational and income levels, planners attempted to

encourage the development of the kind of schools and cultural facilities that seemed appropriate for the town's socio-economic status.[70]

Observers often noted two other features of Richland residents: their relative youthfulness and healthiness. A 1948 report by the AEC's Advisory Board on Safety and Industrial Health described typical "rank and file" employees at atomic facilities as 10 to 15 years younger than the industrial average. In Richland the absence of retirees merely reinforced the youthful character of the town. Only 2.2% of the town's population was over 65 years old in 1960, compared to 10% of all Washingtonians. One husband and wife remembered that there were "no funerals" and "no old people" in Richland during the late 1940s, and that when the wife's elderly mother visited she felt out of place in such a youthful population.[71] A young populace, combined with ample medical care, made for a healthy community. Richland far surpassed national averages by attaining lower rates of worker absenteeism (1.0% to 3.7%), deaths in population over five years (2.7 per 100 to 10.0 per 1000), and infant mortality (18.9 per 1000 to 32.6 per 1000). Master planners saw no need for a large cemetery in town (albeit partly because they expected the deceased to be buried in the places whence they had come to Richland).[72]

The youthfulness of Richland's adults encouraged a local baby boom that, once again, exceeded the national average. In 1948 the town's birth rate stood at 34 per 1000, compared to the national figure of 20 per 1000; in 1950 15.3% of the village

population was under five years old, compared to the national figure of 10.8%. Although Richland's birth rate gradually leveled off during the later 1950s, the town retained a disproportionately large percentage of school children.[73] Because well educated parents paid particular attention to the quality of schools, GE and the AEC worked especially hard to provide an adequate educational system. Plentiful children and good schools apparently reinforced Richland's reputation as a model community.

Although Richland contained a large number of children, many wives worked outside the home. In the Tri-Cities as a whole, about one quarter of all employed workers were women in 1957, and the proportion of working wives was "considerably higher than the national average." (In 1960, Richland fell between Pasco and Kennewick in the percentage of its women in the labor force.)[74] The perception that a disproportionately high percentage of mothers in town worked outside the home emerged in 1957 when the Richland Community Council addressed the issue of juvenile delinquency. The council twice considered--and twice defeated--a proposal urging that the AEC require its contractors to prohibit father and mother from working the same shifts.[75]

If in fact there was a shortage of supervision for Richland's children, it may have stemmed in part from the shortage of grandparents. Most adult residents of the village had moved there from some other part of the country, generally leaving behind their own parents. Yet they now regarded Richland as their home. It remains difficult to determine just how

strongly attached to Richland the newcomers became, but there is considerable evidence of sincere commitment to the new town. An article in The Oregonian of September 9, 1947, headlined "Most Richland Families Stay, Like Stores, Homes," told of the overall contentment with the village. The continual protests against the AEC policy requiring retirees to give up their homes in town also evince people's sense of attachment to Richland. One employee expressed this sentiment in 1955 when testifying before the JCAE: "Our home ties are broken where we came from....[W]e have become established here and wish to make our homes here. Many of us have relatives and, in some cases, children here."[76]

Although HW employees tended to become fond of Richland once they had lived there a while, it sometimes proved difficult to recruit them to the project in the first place. The Army and du Pont had succeeded during wartime in attracting workers especially from the midwestern and southern states and the interior West, and it seems likely that the plant continued to draw heavily for workers upon these parts of the country. (HW continued recruiting in the interior West, but its advertisements in the Denver Post caused Los Alamos to protest. Denver was "the principal point of recruiting for the University of California at Los Alamos," and the laboratory did not wish to compete against the "high rates" of pay advertised by Hanford.) By contrast, GE had a hard time hiring new employees from California, presumably because the Golden State had better cultural and environmental amenities as well as an equally strong economy. And when the

company recruited secretaries from back East, it needed to convince them that they would not be "pioneering" in Richland.[77]

For people who hesistated to relocate to the Tri-Cities area because they feared crude social, cultural, and environmental conditions, the idea of "pioneering" was unpleasant. Those who actually made the move, by contrast, quickly came to view themselves as "pioneers" in a quite positive light. They also favorably identified the place to which they had moved as a kind of frontier. These definitions--of themselves as Westerners and of their new hometown as another western frontier--were important for a number of reasons. First, they helped to cement the social bonds between diverse strangers who had arrived from all around the country, and thus encouraged a sense of community. Second, they provided workers at Hanford and residents of Richland with a positive self-image. Pioneers, after all, have been widely regarded as patriotic citizens performing an important American mission. Third, the image of pioneers on a frontier served Hanford workers and Richland residents as a tool with which they could pry more respect and resources for their communities from the nation. Finally, the ideas of pioneers and the frontier proved quite flexible, and could be adapted and readapted to suit people's changing needs and priorities.

The notion that Hanford and Richland were part of a new frontier began very quickly in the atomic age, between 1943 and 1947. In the early days, the pioneer identity of newcomers stemmed from at least three sets of factors. First, most people at Hanford had arrived recently from the East. Because they were

literally westering overland migrants, it seemed natural to compare their journey to that of earlier generations crossing the Oregon Trail. It also seemed natural to liken their settling among the sagebrush to previous acts of homesteading. Second, the social and environmental conditions at Hanford and Richland during World War Two and immediately after were generally crude. Wartime Hanford had few comforts--such as running hot water--in large part because the Army was afraid to spend too much money on a project that might never work. So employees lived in dormitories and barracks, which comprised a heavily male construction camp, and many of them drank and gambled and whored, and brawled as if they were in some cattle town or mining camp on the frontier. The arid, dusty, windy conditions intensified the discomfort. Those who stuck it out thus quite naturally identified with earlier generations of "pioneers" who had survived similarly harsh conditions.[78]

A third reason for developing an early western identity had to do with a simple geographic calculation. Once the Manhattan Project came out of the closet in August 1945, residents of Richland compared their community frequently to Oak Ridge, Tennessee, another government town created to help produce the atomic bomb during the war. Oak Ridge was the Atomic City of the East; Richland was the Atomic City of the West. This frequently repeated slogan had a number of variations. One was "The Atom-Bustin' Village of the West," which was meant to remind people of the western rodeo. People in Richland participated in atom-bustin' just as cowboys competed in bronco-bustin'.[79]

By 1947, conditions had begun to change dramatically at Hanford and Richland. The post-war expansion not only ushered in another boom period for the community, but also brought a greater sense of permanence to what had been a somewhat temporary town. Growth brought qualitative as well as quantitative gains. The crudity associated with wartime Hanford disappeared as the AEC upgraded the town and plant environments significantly, largely to keep workers content, productive, and on the job. Yet despite such refinements, people continued to identify themselves as pioneers. Some of the same old reasons continued to apply, but new dimensions were also added to the community's distinctive western identity.

The self-image of many who worked at or lived near Hanford was captured now by the idea of the "Atomic Frontier." Indeed, this idea was celebrated in Richland every year from 1948 to 1959 in what came to be known as Atomic Frontier Days. These annual festivals paid homage to the community's supposed similarity to the old West. For example, Richland sponsored an annual rodeo during Atomic Frontier Days, and expected its residents to dress up like cowboys and cowgirls. The town was likened to "the mining and lumbering towns of the early West." Publicists spoke of how, during the war, "the desert fought a savage fight against the invasion of highways, water-power, industry and man." The "unsure" and "unbelieving" could not take the harsh conditions, but like true pioneers "the plucky, the faithful, those who had unbounded belief in the cause, stuck it out." Now they were

engaged in conquering "the Atomic Wilderness on this, our last frontier."[80]

While the idea of the Atomic Frontier called to mind familiar images of the past, however, it also conjured up ideas about the present and the future. The pioneers working at Hanford and living in Richland not only identified with earlier generations of Westerners, but also saw themselves as blazing new trails toward tomorrow. In the world of technology, it was said, Hanford stood on "the industrial frontier." As a "most unique manufacturing concern of our time," with special "engineering knowhow...construction skill [and] unusual operational methods," the plant had greatly surpassed America's already considerable achievements in "mass production" and the "assembly line method." Its product, plutonium, also seemed path-breaking--"usable a thousand years from now for war or peace....It is owned by a free people; it bears a union label."[81] The spirit proved so infectious that others involved in more mundane kinds of work tried to participate. One entrepreneur opened a new restaurant in 1952 called "Fission Chips."[82]

Existing on the frontier--the cutting edge--of industry and technology meant, of course, that Hanford and Richland were also pioneering tomorrow. Certain that peaceful uses of the atom would usher in a "golden age" for Americans, the people of Hanford and Richland imagined the Tri-Cities as a "Crossroads of the Future":

> History will record a new Western saga when the story of the Tri-Cities is told...of a region triply blessed

> with water, sun, and land, plus the indescribable, fantastic, development of atomic power; Conestogas replaced by snarling trucks, horses by hotrods, false-fronts by graceful steel and stone buildings, and the legendary tent-towns by thousands of trailers--most of whose occupants will join a useful citizenry to build this modern colossus in central Washington state.[83]

Just as the Hanford plant would guide other Americans along the trail to the future, so would Richland. The town was not only "one of the world's great pioneer centers in atomic science and industry." Because of its origins as a planned, government town, and because of its generally prosperous and homogenous population, Richland was also perceived by many as a <u>model</u> community.[84]

Notions of Hanford and Richland as industrial, technological, and urban frontiers prevailed especially in the later 1940s and 1950s but, like prior associations with an older West, this futuristic self-image persisted even as still another identification with the frontier emerged. Throughout the years from the mid-1950s to the early 1970s, the people of Hanford and Richland made a number of requests from the federal government. In asking the government to extend certain benefits to their communities, they once again frequently identified themselves as pioneers, this time emphasizing the sacrifices they had made in the West for their country. The implication was that the nation owed them something extra because of the pioneering they had gone

through, just as it had owed special consideration to early migrants on the overland trail of the mid-nineteenth century.

The people of Richland made particular use of the self-image of the sacrificing pioneer. Employees who appealed for permission to remain in the village after retirement from the plant buttressed their arguments by emphasizing the severe disruption that forced departure would wreak "in the settled habits a person develops in pioneering a home such as has occurred here."[85] Pioneers apparently put down deeper roots. Furthermore, although Richland had been essentially created by the government and its contractors, the residents emphasized that it was <u>their</u> efforts as individual pioneers--not those of the federal government, its corporate partners, or its planners--that accounted for the town's success. One woman demonstrated this sentiment in a 1955 statement to the JCAE.

> Since Richland changed from a sleepy country village, I watched it grow, pioneered it with the rest of the oldtimers. We've lived through heat and dust storms with no flowers, no grass, no trees and we put in grass and had to water it constantly so it could live in the hot dry desert air. We had no stores, no entertainment facilities and there were many other handicaps. Now Richland is a beautiful place.[86]

In other words, if Richland was in fact a model community, the tenants and not the landlord deserved the credit.

In order to get a better sense of the meaning of the idea of Richland as model community during the late 1940s and the 1950s, one might compare the government town to Pasco and Kennewick, the other two members of the Tri-Cities. Prior to World War Two, Pasco's economy had revolved around the railroad and Kennewick's around the processing and shipping of farm produce. These economic orientations continued during and after the war.[87] Yet both towns were also influenced dramatically by the arrival of Hanford and Richland. Pasco grew from 3,913 people in 1940 to 10,228 in 1950 and 14,522 in 1960. Kennewick expanded from 1,918 in 1940 to 10,106 in 1950 and 14,244 in 1960. (See Table One.) Both towns became more affluent during these two decades, partly because each of them, and especially Kennewick, housed an increasing number of Hanford employees and their families.[88] The plutonium plant introduced a manufacturing economy that increased the prosperity of the entire region, and in so doing made disparate towns more similar in certain ways.

Table One[89]: Demographic Comparsions, 1950-1960

	Pasco	Kennewick	Richland
1950 Population	10,228	10,106	21,809
1960 Population	14,522	14,244	23,548
% Increase, 1950-1960	42%	41%	8%
1950 Blacks	980	4	7
1960 Blacks	1213	5	189
1950 % Non-whites	10.1%	0.1%	0.2%
1960 % Non-whites	9.0%	0.3%	1.3%
1950 % aged 65 or over,	5.1%	4.7%	1.2%
1960 % aged 65 or over	6.3%	5.8%	2.2%

Table Two[90]: Socio-economic Comparisons, 1950-1960

	Pasco		Kennewick		Richland	
	1950	1960	1950	1960	1950	1960
Median Family Income	$3972	$6,590	$3,750	$6,598	$4,864	$8,368
% of Families below poverty line ($2000)	24.4	16.0	25.2	10.4	4.9	4.1
Median Years of schooling	11	12.1	11.3	12.1	12.5	12.6
% High School Graduates		53.5		54.6		74.3
% Unemployed	12.7	6.2	11.3	7.1	3.7	4.2

Having said that, the differences between the three towns remained sizeable through the late 1940s and the 1950s. (See Tables Two and Three.) Richland was, simply put, the biggest, wealthiest, and best educated of the communities. Its median

family income for 1950 ($4,864) and 1960 ($8,368) substantially exceeded Kennewick's ($3,750 and $6,598) as well as Pasco's ($3,972 and $6,590). Whereas about one quarter of the households in Pasco and Kennewick earned less than $2,000 in 1950, less than one twentieth of Richland's did. In 1960, about 60% of Richland's labor force worked in manufacturing, compared to Kennewick's 19.8% and Pasco's 9.6%. Three quarters of Richland's adults had completed high school, compared to slightly more than half of the adults in the other two towns. In 1960 about 6% of the population of Kennewick and Pasco was 65 years or over; only 2.2% of Richland's residents fell into the same age bracket.

Table Three[91]: Nature of Tri-Cities Employment

	Pasco		Kennewick		Richland	
	1950	1960	1950	1960	1950	1960
Size of Labor Force	4630	5760	4087	5549	9146	9508
% Employed in white collar jobs		44.8		46.9		54.6
% Employed as Laborers	9.4	7.4	12.3	5.8	2.4	2.4
% Employed in Construction	21.8	14.7	38.2	16.0	9.7	2.5
% Employed in Manufacturing	6.2	11.6	14.5	23.9	65.7	68.3

The distribution of racial minorities also differentiated between the Tri-Cities. Hanford employed very few African Americans--a situation that attracted the critical attention of the Seattle Chapter of the American Civil Liberties Union and the National Urban League in 1949. The Urban League investigator

reported that most of the African-American population of the Tri-Cities--perhaps as many as 2,000 people--lived in a squalid encampment, without city utility service, on the east edge of Pasco. Blacks were not very welcome in other places. The sheriff of Kennewick explained the racial homogeneity of his community by reporting that "if anybody in this town ever sells property to a nigger, he's liable to be run out of town."[92] Other laborers who did not "fit into" the AEC "community," including Hispanics who had roots nearby, were encouraged to continue commuting from Sunnyside or Prosser, rather than trying to move into Richland.

The federal government, in the form of the AEC, did little to alter the official policies or pervasive attitudes of local citizens. Once again, the emphasis on production took priority over other matters. The AEC's deputy manager at Hanford explained to the Urban League investigator, "We have enough trouble here without having to cope with a Negro problem. We've got to think of our white majority, many of whom are southerners and would not stand for Negroes here."[93] So the number of African-American employees remained miniscule. Two blacks, a typist and a clerk, worked for the AEC at Hanford in 1951; "less than a dozen Negro clerks and custodians" were employed by General Electric; and about 250 blacks worked for construction contractors. Many of the African Americans employed in construction lived in North Richland, where housing facilities and some eating establishments were segregated. In Richland proper, there were "occasional instances where the use of eating

and recreational facilities by non-whites has been discouraged," an AEC study revealed in 1951, but housing was not segregated.[94]

In March of 1953, after President Eisenhower ordered the desegregation of all schools on U.S. military bases, the AEC anticipated that it would soon receive instructions to have its towns comply with the same requirements. Among the three atomic towns, the President's order would only affect Oak Ridge, Tennessee, according to two AEC officials, because, as they wrote, "There is no school segregation at Hanford or Los Alamos."[95] The statement was technically correct in Richland's case, largely because there were so few African Americans in the town. The 1950 census had counted 7 African Americans in Richland; non-whites comprised but 0.2% of the town population. Kennewick similarly contained only 5 African Americans in 1950. Pasco, on the other hand, officially had 980 African Americans; 10.1% of its population was non-white. Because all but 27 of the African Americans had arrived in Pasco since 1940, one suspects that wartime migration, and particularly the importation of workers to build Hanford, was largely responsible for the increase of non-whites in Pasco.[96] By 1960, the number of African Americans in Richland had grown to 189, and non-whites amounted to 1.3% of the population. The comparable numbers for Pasco were now 1,213 and 9%.[97] Hanford still did not employ many African Americans. As late as 1966, blacks amounted to about one percent of Hanford employees--or 82 out of a total of 8,000--so contractors were instructed to hire more African Americans.[98]

In Richland, the lack of racial diversity contributed to the town's sense that it was special and different. Although peopled by newcomers from all over the country, the village of Richland was homogeneous in many ways. Its population was overwhelmingly white, its employees were paid fairly well, its residents generally worked for and followed the lead of either GE or the AEC, and its homes shared a mass-produced character. One observer called Richland "a middle class housing project." Compared to its neighbors, the village had more cultural facilities, better schools, and a higher level of city planning. Furthermore, as one former resident recalled in 1990, the town's adult population was going through much the same experience:

> we were all young when we were first hired in there. There weren't any old people to speak of in town, and everybody was in the same boat. We all came in there with the jobs and the job that they wanted us to do and we all had our families there and everybody got along.[99]

The distinctive character of Richland was reinforced by official policy. Because the government saw Richland as a hometown for production workers at HW, it tended to isolate it from surrounding communities. Most of the construction workers employed in Hanford's post-war expansion did not live in the village. In 1950 less than 10% of Richland wage-earners worked in construction, while 22% of Pasco's and 38% of Kennewick's were employed in construction. Moreover, when starting the expansion program in 1947, the government steered construction workers away

from the village toward the new, temporary town of North Richland--a working-class housing project--where they were sheltered in barracks and trailers. One difference between Richland and North Richland was that in 1950 the construction town contained about 200 African American residents among its population of 3,067. North Richland also voted heavily Democratic, while Richland leaned to the Republican Party. The workers living in North Richland were permitted to bring their families, in contrast to most wartime employees at Hanford camp, but they were still perceived (somewhat correctly) as transients and as a source of social problems. Increases in venereal disease and crime were attributed to the presence of construction workers during the late 1940s.[100]

Richland was, by design and by circumstance, different from and isolated from the surrounding communities. Its population perhaps challenged the status quo of the nearby rural population. Some perceived the newcomers as aloof or arrogant.[101] Many long-term residents of the area were no doubt suspicious of so many newcomers from afar. Furthermore, the government had wished to keep Richland isolated from its neighbors during the war for security reasons, so it had provided for few roads between the village and other towns. And it seemed to be in no rush to increase access to the town after the war. As late as 1955, Richland residents continued to complain about their lack of communication with other towns, a problem that particularly affected businessmen who wanted to expand their markets.[102]

Richland was both quite different and rather isolated from nearby towns and farms, and its devotion to one industry set its economy apart. Hanford exerted enormous influence on the entire Tri-Cities area, changing Kennewick and Pasco in significant ways and integrating them partially into a more industrialized, government-supported economy. But Richland remained decidedly different. The town's detachment likely served the interest of the AEC and GE, but it was not necessarily the aspiration of local residents and promoters. As early as 1948, the master planners employed by GE and the AEC expected that Richland's future growth depended upon the completion of the Columbia Basin Project. Local leaders, too, in the early 1950s tended to lump Richland together with Pasco and Kennewick as a single economic unit that stood to benefit from the presence of cheap hydroelectrical power, the expansion of irrigated agriculture, and the improvements to river transportation promised by completion of the Columbia Basin Project.[103] Boosters had somewhat misleadingly grouped the three towns together as a single metropolitan unit--the Tri-Cities--as well as a single common economy.

The image of three distinct communities marching in step toward a single, bright future overlooked the fact that in some respects the Hanford Works and the Columbia Basin Project, as originally conceived, were incompatible. For one thing, the plant required an uninterrupted flow of the river's fresh, cold water, and thus its presence prevented construction of the proposed Ben Franklin Dam on the Columbia. Hanford also required

an uninterrupted flow of hydroelectric power, so both during and after the Second World War it secured a guarantee from the Bonneville Power Administration that placed HW above all other users.[104] For another, the Hanford project tied up lands that had once been slated to receive water as part of the Columbia Basin Project's irrigation effort. As one example, Hanford encouraged the urbanization of areas in and around the Tri-Cities, which resulted in the conversion of prospective irrigated farms into homesites in order to meet the demand for new housing. Even more consequential, however, was Hanford's takeover of the Wahluke Slope across the Columbia River in Franklin and Grant counties, just north and northeast of the reactors.

Government control of much of the Wahluke Slope represented a precaution against the possibility of an accident at the Hanford plant. In the event of a disastrous release, it was believed, the prevailing winds would likely carry radioactive gases north and northeast from the reactors, across the river and on to or over the Wahluke Slope. Consequently, in 1947 the AEC determined that it needed to prevent occupation or development in more than 280,000 acres on the slope. Of this parcel, 88,000 acres comprised the Control Zone, along the riverbanks and nearest the reactors, where the AEC sought "complete and permanent control" by condemning and purchasing all non-government private land. The remaining acreage, mostly privately owned, was designated the Secondary Zone. The AEC prevented development and settlement in this area, too, largely by getting the U.S. Bureau of Reclamation to agree not to extend irrigation

to it. But the AEC also held out hope that advances in reactor safety would ultimately permit it to release these lands for development and habitation.[105]

AEC uses for the Wahluke Slope conflicted directly with the proposed uses by the Columbia Basin Project, which had offered the possibility of irrigating many of the acres. Landowners and businessmen did not like this interference with local economic development, and the Bureau of Reclamation pointed out that, minus the lands now under AEC control, the development of irrigation in the vicinity would be more expensive and less cost-efficient. Naturally, then, pressures from farmers, landowners, local businessmen, and the Bureau of Reclamation emerged, forcing the AEC to re-evaluate and, on two occasions, reduce the size of its Secondary Zone during the 1950s.

Announcement of the first change came on January 8, 1953, when the AEC released roughly 87,000 acres from the extreme southeastern and northwestern ends of the Secondary Zone. The Commission also indicated that it would permit the temporary construction of canals and roadways through the remaining restricted areas, but would continue to oppose occupation or regular work there. In publicizing this decision, the AEC carefully explained that hazards from the possibility of reactor accidents still existed. It promised to educate people who would be working or living in the newly released lands to the dangers they faced, and to provide a warning and evacuation system for emergencies. The AEC also reiterated its policy that "for safety reasons no towns or cities should be established within 25 miles

of the Hanford reactor area." A limit of this size did not apply at all atomic sites, however. C. Rogers McCullogh, chairman of the AEC's Advisory Committee on Reactor Safeguards, explained in a 1958 letter to AEC Chairman Lewis L. Strauss just why Hanford's "unique" reactors continued to present considerable concern.

> The Hanford reactors have been and still are potentially dangerous facilities because of the massive escape of fission products which would occur in the event of loss of coolant. This hazard becomes progressively more serious the higher the power level at which the reactors are operated. In allowing these reactors to operate at the present power levels or at the proposed increased power levels, the Atomic Energy Commission is accepting a degree of risk which, in the opinion of the Committee, is greater than in any other existing reactor plant.[106]

In releasing the 87,000 acres in 1953, the AEC built expectations for additional releases of land by promising that improvements in its "safety systems" at Hanford would soon reduce the dangers associated with the possibility of accidents. Four years later, however, the gains in reactor safety had been offset by increases in power and productivity, which meant that the AEC still regarded further releases of additional acreage on the Wahluke Slope as too risky. Nonetheless, demands from local interests and private owners to release more land remained intense. The Columbia Basin Commission hinted in mid-1957 about filing suit against the AEC for release of more of the Wahluke

Slope, and in October Senator Henry M. Jackson presided at informal hearings in Richland on the matter. AEC officials explained then that, in their best scientific opinion, releasing additional acreage on the Wahluke Slope remained undesirable from the point of view of saftey. But Senator Jackson, local farmers and landowners, and representatives of the Bureau of Reclamation all disputed official reasoning. They did not have the expertise to challenge AEC worries about the hazards of Hanford reactors, but they did resent being told they could not decide for themselves whether to live with those hazards, if they wished, in pursuing the "potential prosperity so rightfully theirs in keeping with American ideals."[107]

Among those advocating the opening of more of the Wahluke Slope, the prevailing sentiment was that they were "willing to accept that challenge" (that is, the possibility of a nuclear "disaster" at HW) because in living next door to Hanford they were "not in any worse position than any other spot that you pick out." A 1951 AEC report noted:

> Members of the Columbia Basin Commission have advised the Hanford Operations Office informally that, since bombing is a civilian hazard commonly faced in any locality adjacent to defense plants, or in key cities, it should not be given any added weight in appraising the hazards on the Wahluke Slope.

The Commissioners also claimed that "even a direct hit on a pile would cause only a localized disaster."[108]

Senator Jackson reiterated this reasoning in his appeal to the AEC to relax its standards. Given the stockpiling of nuclear weapons at sites across the country, the thousands of people now working with fissionable materials, and the enemy's nuclear capabilities, "millions of Americans in this atomic age," according to Jackson, were living with the risks inherent in "new defense systems." So, he reasoned, it did not make sense to single out Hanford's hazards as any greater than those to which most of the country's population was exposed. "Life is indeed dangerous in this century of tension," and it "is becoming more hazardous every day."[109] Preventing economic development in the vicinity of Hanford did not make sense, according to the Senator, because the people living or working on the Wahluke Slope would be at risk no matter where they were.

Jackson's argument neatly ignored the fact that, as the AEC said, occupants of the Wahluke Slope would face considerably more risk than other Americans by virtue of their being downwind from Hanford's reactors. Nonetheless, the political and public pressure to open additional acreage on the Wahluke Slope remained strong, and on December 30, 1958 the AEC yielded to that pressure and released another 105,500 acres from the Secondary Zone. The commission explained that it had scheduled improvements in making reactor buildings more airtight, thereby reducing the risk of exposure to radiation "in the event of a reactor accident short of catastrophe," but clearly the hazards presented by the possibility of a serious disaster remained. Typically, however, local businessmen and landowners, elected officials, and the

Bureau of Reclamation all welcomed news of the additional release, because 62,000 of the newly opened acres were irrigable and thus promised an economic gain to the region.[110]

Resisting calls for opening more of the Wahluke Slope to development put the AEC in a difficult position. It had articulated its concerns that operation of the Hanford reactors posed special dangers to neighboring populations, but this admission of the public hazards of plutonium production went against the overall trend of the plant's public relations effort. The AEC much more consistently and persistently emphasized the safety of HW rather than the risks it presented to surrounding areas. Indeed, no doubt because of its overriding devotion to production above all else at Hanford, it generally seemed incapable of dwelling on the special hazards that the reactors presented, and its concern for the plant's effect on the surrounding environment developed but slowly.

The 1948 report of the Safety and Industrial Health Advisory Board to the AEC examined the safety of AEC operations generally and of Hanford operations specifically. It praised the precautions that had been taken since the beginning of the Manhattan Project for protecting employees from the hazards of radiation. Indeed, it even predicted, somewhat rashly, that the AEC "need not be unduly concerned about damage suits" arising from workplace conditions, "for the simple reason that your health and safety records are much too good." Protection against "the public health hazards to AEC communities and to the surrounding regions," on the other hand, had not received enough

attention, according to the report. The Army Corps of Engineers and the AEC had accepted emissions into the air, ground, and water without due consideration for their impact on the nearby environment and population, and they had developed virtually no valuable data about these releases.[111]

The report challenged specific practices at Hanford. It criticized the amounts of radioactivity released into the Columbia River, and it questioned the disposal of "'hot' wastes" into holding tanks. It particularly criticized gaseous emissions from the stacks at the chemical separations complex:

> At Hanford the discharge of certain radioactive or chemically toxic materials, such as iodine, fluoride and argon, is not infrequent. Oxides of nitrogen are also discharged in substantial quantities. Their effects on the surrounding land and general biologic life, including man, remain to be evaluated.

Herbert M. Parker, the leading health physicist at Hanford, conceded further that "Neither the general public nor its responsible agencies have been given an opportunity to discuss their own safety with respect to effluents."[112]

The 1948 report demonstrated official awareness of and concern about the environmental and public-health impact of Hanford on the area, but it also demonstrated the difficulties that officials would have in informing Hanford's neighbors of the risks. In the document Herbert Parker declared, "now that the Hanford Works has a long term future," the AEC needed to calculate "the advantages of public reassurance against security

requirements."[113] In other words, the commission needed to choose between maintaining total secrecy and providing just enough information to reassure the nearby public about their health and environs. Parker saw no need for full disclosure of all problems--partially because he doubted that the health problems were serious; partially because public disclosure of Hanford's emissions might have provided classified information to the Soviet Union and other nations about America's production of fissionable material; and partially because studying the problems, educating the public about them, and making changes to the plant in order to address them, all threatened to detract from HW's overriding mission to maximize production of plutonium. In 1954, when Parker urged the AEC not to disclose levels of radiation in the Columbia River, he explained that "The public relations impact would be severe."[114]

Hanford's neighbors thus did not learn about the dangers to which they were exposed. Perhaps some of them wondered about the hazards of living on the production frontier. But most residents of the area did not question the official complacency about Hanford's effect on public health and the environment. In fact, the risk-taking attitudes of local citizens and Senator Jackson toward the lands of the Wahluke Slope--that is, their eagerness for local people to be able to choose for themselves whether to live with the unknown hazards associated with Hanford, regardless of the AEC's advice--suggests that even fuller disclosure by the AEC regarding the dangers of reactor operation may not have

deterred those devoted to pursuing in the shadow of the plant that "potential prosperity so rightfully theirs."

In any event, the AEC and GE did not hasten to change their practices regarding the public. On-site employees, for example, continued to receive some information about the risks of radiation, but people off the reservation did not. When airborne emissions of radioruthenium particulates became a problem in 1954, travel within the Hanford boundaries was restricted but people off-site were not warned. "Nothing is to be gained by informing the public," Parker explained.[115] In 1949 the AEC and GE asked public health officers from Oregon, Washington, and the U.S. Public Health Service to join together as the Columbia River Advisory Group in order to help monitor radioactive releases into the river (which would increase greatly over the 1950s). The government and its contractor doubtless hoped that these advisors would help instill public confidence in HW waste practices, but they proved to be more independent than the AEC and GE thought desirable. In 1954 the advisory group even drafted its own report, critical of HW policies, which contained statements that, if released, "would have been highly damaging to public relations," according to Herbert M. Parker.[116]

* * *

The advent of the Hanford Works had an enormous impact on south central Washington. It transformed the environment and the rural character of the region, at times challenging the future role of the Columbia Basin Project, and it simultaneously modernized and industrialized the economy of the Tri-Cities. It

spawned the permanent new city of Richland, which was identified as both an "above-average community" and a "model community." The Hanford Works itself was seen as a force on America's frontier, defending the nation and at the same time leading other Americans toward a new technological future. But if the plant was regarded as both a local and a national asset, it was not always an above-average or model neighbor locally. Its mission to produce as much plutonium as possible, in the shortest time and at the least cost, and its managers' interpretation of how best to execute that mission, prevented it from protecting, as much as it might have, the interests of those living and working in proximity to it. Similarly, the local population generally focused on the short-term gains it was receiving from the plant. Only in retrospect have the long-term costs of having Hanford as a neighbor become public and understood.

NOTES TO CHAPTER TWO

1. "Background Material on Hanford Works," 1963, RPL-CF-GE-Hanford Works through 1959, p. 2; Richard G. Hewlett and Francis Duncan, Atomic Shield, 1947/1952, vol. II, A History of the United States Atomic Energy Commission (University Park, PA, 1969), 145-46; Parker cited in AEC, "Report of the Safety and Industrial Health Advisory Board," (Washington, D.C., 1948; AEC-10266), 81; Richland Day Souvenir Program, Sept. 1, 1947, RPL-CF-Richland-Description, Guidebooks file, p. 3.

2. Necah Stewart Furman, Sandia National Laboratories: The Postwar Decade (Albuquerque, 1990), chs. 12-13.
Although Oak Ridge was managed by an industrial organization, it became a National Laboratory and conducted research and development tasks as well.

3. "The Great Inquiry: Testimony at AEC Hearings," Bulletin of Atomic Scientists 5 (August-September, 1949): 240.

4. Richard Rhodes, The Making of the Atomic Bomb (New York, 1986), 765.

5. Lt. Col. Frederick J. Clarke to District Engineer, Oak Ridge, Nov. 21, 1946, MRCF-DF, Box 108; J.E. Travis to Director of Operations, AEC, Oak Ridge, April 3, 1947; Col. P.F. Kromer, Jr., to Carroll L. Wilson, April 29, 1947, MRCF-ACC, Box 219; J.E. Travis to Director of Operations, Oak Ridge, May 19, 1947, MRCF-ACC, Box 219.

6. Michele Stenejhem Gerber, On the Home Front: The Cold War Legacy of the Hanford Nuclear Site (Lincoln, 1992), 31, 33; Hewlett and Duncan, Atomic Shield, vol. II, 146; TCH, Jan. 9, 1964.

7. HEWMR, 1/47, p.110; RCC, "Richland Census Data - August 1958," (August 25, 1958), FCP2.

8. L. L Wise, "The Richland Story--Part I: Development and Management," Engineering News-Record, 143 (September 8, 1949):16.

9. "The Great Inquiry," 242.

10. Frederick J. Clarke to P.F. Kromer, March 24, 1947, MRCF-ACC, Box 45; D. S. Lewis, "Operating the Hanford Reactors," Electrical Engineering 76 (November, 1957):951. This idea that Hanford was a rather unexceptional industrial operation was reiterated in a 1961 column by Ted Van Arsdol. Criticizing the sensational media coverage of a nuclear accident that killed three people at Arco, Idaho, Van Arsdol lamented the fact that "atomic energy public relations men haven't been able to 'sell' outsiders on the idea of atomic workers going about their work

routinely in an industry tending toward a more normalized condition." Ted Van Arsdol, Dateline--Hanford (Vancouver, Wash., 1964), 15.

11. Jack Curts to Walter J. Williams, Aug. 21, 1947, pp. 1, 3, 5, MRCF-ACC, Box 43; Curts to Williams, Aug. 21, 1947, MRCF-ACC, Box 45.

12. Curts to Williams, Aug. 21, 1947, MRCF-ACC, Box 45. Placing a monetary value on the risks faced by workers at HW was done more than once. Life-insurance companies were having a hard time trying to determine whether to write policies on AEC and contractor personnel at Hanford. So in early 1947 the AEC invited two individuals, including a chemical engineer, from the Home Office Life Underwriters Association to inspect the plant and create categories for insurees by rating the different job risks. The assorted insurance companies apparently accepted the investigators' decisions. See William J. Satterfield, Jr., to Roger Harris, Jan. 30, 1947, MRCF-ACC, Box 219.

13. Oscar Smith, "Letter to be sent to GE -- Dictated from Richland," March 8, 1949 (draft), 47-51Sec, 1234:23, pp. 1-5.

14. "The Great Inquiry," 229.

15. HWMR 6/49, pp. 3-6; TCH, Dec. 12, 1958.

16. D.L. De Neal, "Historical Events--Reactors and Fuels Fabrication," July 1, 1965, PRR, Accession # 8405.

17. Gerber, On the Home Front, ch. 7.

18. Gerber, On the Home Front, 37-39.

19. M.W. Boyer (AEC General Manager) to Robert LeBaron (AEC Military Liaison Committee), June 18, 1952, in 51-58Sec, 1282:10. The comment was made in the context of siting the KE and KW reactors. The AEC could not afford to wait to locate them in a more militarily defensible location. Ironically, one of these reactors malfunctioned shortly after startup, and investigators blamed the haste of construction and early operation for the problems. See D.G. Sturges, T.W. Hauff, and C.E. Greager, "Investigation of the KW Reactor Incident," Feb. 11, 1955 (PRR, HW-34834), 4-12.

20. Michael D'Antonio, Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal (New York, 1993), esp. 112, 154, 156, 239, 274, documents this orientation for the mid-1980s.

21. "ACRS Report on Modifications to Hanford Reactors," February 4, 1958, AEC 172/22, pp. 1-2, SEC 1284:8; quotation cited in Gerber, On the Home Front, 102-103.

22. Dean cited in Deutschmann, "Federal City," 96-97.

23. Deutschmann, "Federal City," 85; 2nd Annual Atomic Frontier Days Program (Richland, 1949), 9, 23.

24 Deutschmann, "Federal City," 146-47; "The Great Inquiry," 229, 230; Gerber, On the Home Front, 37-39.

25. Deutschmann, "Federal City," 54-57.

26. Wilson cited in Marjorie Bell Chambers, "Technically Sweet Los Alamos: The Development of a Federally Sponsored Scientific Community" (Ph.D. dissertation, University of New Mexico, 1974), 298; Deutschmann, "Federal City," 96, 6-7; Jack M. Holl, "The National Reactor Testing Station: The Atomic Energy Commission in Idaho, 1949-1962," Pacific Northwest Quarterly 85 (Jan. 1994): 16; M. Mead Smith, "Labor and the Savannah River AEC Project: Part III," Monthly Labor Review 75 (Aug. 1952):150-51.

27. Deutschmann, "Federal City," 97-99.

28. Deutschmann, "Federal City," 260-61.

29. Donald O. Carlson, "Atomic Workers at Hanford Enjoy Modern Bus System," Bus Transportation 30 (April 1951): 41 (1st qtn.); "The Great Inquiry," 245; Deutschmann, "Federal City," 140-141, 275 (2d qtn.); Lyman S. Moore to Carroll L. Wilson, Feb. 8, 1947, 47-51Sec, 1231:15.

30. Carroll L. Wilson, "Instruction GM-63, Community Management: Determination of Community Policies," Dec. 15, 1947, 47-51SEC, 1231:15; "Municipal Incorporation Urged for Two 'Atom Tomws,'" American City 66 (Sept. 1951):139.

31. Fred Clagett, "Comparison of Oak Ridge and Richland," Sept. 25, 1953, FCP. See also Minutes of RCC, Sept. 25, 1953, FCP.

32. AEC, "Report of the Safety and Industrial Health Advisory Board," 10; SSR, July 24, 1949; "The Great Inquiry," 237.

33. AEC, "Report of the Safety and Industrial Health Advisory Board," 11, 92, 96; SSR, July 27, 1949.

34. George L. Prout cited in Deutschmann, "Federal City," 86, 192; GE, "Atomic Test".....at Hanford Works, Richland, Washington (n.p., n.d.) RPL-CF-GE-Hanford Works file.

35. Deutschmann, "Federal City," 125.

36. Deutschmann, "Federal City," 134-35, 243-46, 263-66. Townspeople did elect their own school board.

37. Deutschmann, "Federal City," 274; Minutes of RCC, May 1954, FCP; Clagett cited in JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a Subcommittee on Disposal of Government-Owned Communities of the Joint Committee on Atomic Energy...June 18 and 19, 1954 (Washington, 1955), 16. Background to the origins of the Richland Community Council is provided in TCH, Dec. 11, 1959, clippings on file in HMJP-3, 52:10.

38. Minutes of RCC, Aug. 25, 1952.

39. Minutes of RCC, Aug. 17, 1953, July 6, Nov. 22, 1954, FCP.

40. Pertinent correspondence is located in WGMP-3, 103:7. The papers do not hint at how the problem was resolved. The AEC had hoped that prompt passage of a disposal bill by Congress would permit it to sell the house to its tenant before he retired, but sales of homes did not begin quickly. Any other solution to the problem would have violated AEC policies.

41. Pertinent correspondence is located in HMJP-3, 24:1. As with the previous example, the rights of privacy prevent us from providing more details, such as the individuals' names.

42. Deutschmann, "Federal City," 295-97, 283.

43. Minutes of RCC, April 9, 1951, FCP; Deutschmann, "Federal City," 268-69.

44. Deutschmann, "Federal City," 295-96; Minutes of RCC, March 17, 1952, FCP.

45. David F. Shaw, interoffice memo, Hanford Directed Operations, Sept. 17, 1947.

46. J. Gordon Turnbull, Inc., and Graham, Anderson, Probst, & White, Inc. [cited hereafter as JGT], Master Plan for Richland, Washington, prepared for GE, Nucleonics Department, Hanford Works, and USAEC, Hanford Operations Office (Chicago, 1949), 3. In the course of researching this study, the authors found a copy of the Master Plan in the Richland city offices in 1991. Unlike most 43-year-old (or 10-year-old) planning documents, this one was still in regular use.

Gordon Dean, Chairman of the AEC, heard from "Congressman Thomas of Texas" about the rather luxurious quality of the document. See Transcript of Gordon Dean Office diary, entry for Oct. 12, 1951, EHC.

47. JGT, Master Plan for Richland, Washington, 70, 72; HWMR 11/49, p. 6. In summarizing JGT's approach to Richland, the "chief planner" for the firms hired by GE noted that his companies' efforts were enhanced by the presence of "a central controlling, non-elective government" and the fact of "no private

ownership problems." Richland may have been a planner's dream. See George W. Wickstead, "Planned Expansion for Richland, Washington: A.E.C. Development Embraces All Phases of Land Planning," Landscape Architecture 39 (July 1949):167.

Congressman Thomas from Texas (see previous footnote) also worried, in a phone conversation with Gordon Dean, that the Richland Master Plan provided too much information about the layout of Richland. (He seemed not to understand that the Hanford production site and the village of Richland were more than twenty miles apart.) Dean Diary, Oct. 12, 1951.

48. JGT, Master Plan for Richland, Washington, 6, 1 (qtn.).

49. JGT, Master Plan for Richland, Washington, 8.

50. J.E. Travis to Director of Operations, Oak Ridge, March 20, 1947, MRCF-ACC, Box 50; Travis to Director of Operations, Oak Ridge, April 10, May 19, 1947, MRCF-ACC, Box 219; [Frederick J.] Clarke to S.R. Sapirie, teletype, n.d. [May 1947], MRCF-ACC, Box 219.

51. JGT, Master Plan for Richland, Washington, 8, 18; Deutschmann, "Federal City," 116, 116n.

52. Carl Abbott, "Building the Atomic Cities: Richland, Los Alamos, and the American Planning Language," paper presented at Atomic West Conference, University of Washington, Sept. 25-27, 1992.

53. TCH, June 4, 1968, Nov. 12, 1969; Deutschmann, "Federal City," 120-24.

54. Deutschmann, "Federal City," 167-69; Clagett cited in JCAE, Disposal of Government-Owned Community at Richland, 20.

55. JGT, Master Plan for Richland, Washington, 2, 6, 24.

56. JGT, Master Plan for Richland, Washington, 36. While advocating more parks and playgrounds, the plan advised against committing more than one acre per every 100 people to such uses because, in the arid conditions, it would become too expensive to water the lands.

57. JGT, Master Plan for Richland, Washington, 36, 38; GE Community Operations, Annual Report: A Review of Community Progress during the Past Twelve Months (Richland, 1953; RPL-CF-Richland-Description file); Wise, "The Richland Story--Part I," 42; HWMR 4/50, p. 287; Gerber, On the Home Front, 63-64; AEC, "Report of the Safety and Industrial Health Advisory Board," 72 ("products" qtn.).

The planting effort recommended by JGT was clearly a continuation of a program already under way. A full-scale effort to provide "protection from the desert sun and wind" and curtail "the dust menace" was conceived in late 1946 and early 1947 as a

means of preserving "the health and morale of the workers and their families." One AEC official, in supporting the proposal, claimed that the government now needed to work especially hard to safeguard morale. Conditions had been different during the war, he claimed, "since patriotism being then paramount it was not too difficult to retain personnel, at this isolated location, under conditions which would not now be possible." General Groves and Colonel Matthias might have been interested to hear how easy the wartime job of retaining personnel had been! R.L. Brown, "Recommendation Report No. 78; General Planting Program--Richland," Dec. 23, 1946, MRCF-ACC, Box 49, esp. p. 1; J.E. Travis to AEC Director of Operations, Oak Ridge, March 7, 1947, MRCF-ACC, Box 219. Comments on wartime patriotism came from A. Tammaro to Carroll L. Wilsom, March 5, 1947, MRCF-ACC, Box 219.

58. HEWMR 9/46, p. 91; HEWMR 1/47, p. 148; HWMR 6/47, p. 153; HWMR, 1/48, p. 208; HWMR 5/48, p. 211; HWMR 6/52, pp. G-10 to G-11, LC-3.

59. Gerber, On the Home Front, 72-74, makes the speculative connection between AEC controls on plants and animals and the desire to contain the spread of radioactive emissions.

60. Public Administration Service [hereafter cited as PAS], A Report on the Feasibility of Municipal Incorporation and Real Estate Disposition in Richland, Washington, prepared for the U.S. Atomic Engergy Commission (Chicago, 1950), 67-68; HEWMR, 1/47, p. 109.

61. TCH, March 12, 1978; JGT, Master Plan for Richland, Washington, 14, 18.

62. Richland Villager, March 2, 1950.

63. PAS, A Report on the Feasibility of Municipal Incorporation, 67-68.

64. RCC, "Richland Census Data, August 1958"; Deutschmann, "Federal City," 201-203; CBN, July 3, 1958. The shortage of housing in Richland was analyzed in "Decision on AEC 373; Construction of Houses at Hanford--Proposed Letter to Bureau of the Budget," October 6, 1950, 47-51Sec, 11238:4.

65. PAS, A Report on the Feasibility of Municipal Incorporation, 66; U.S. Housing and Home Finance Agency, Community Disposition Office, Richland, Wash., "A Commerical and Industrial Survey of Richland, Benton County, Washington," DRAFT, (Richland, 1957; FCP), 15-16. On "model" community, see Richland--Richland, Washington: A Key City of the Atomic Age (n.p., n.d.; RPL-CF-Richland-Annual Reports file); Abbott, "Building the Atomic Cities."

66. "Interview with Betty Jacobs, Class of 1943," by Peggy Corley, Nov. 5, 1990, Eells Northwest Room, Penrose Library, Whitman College, Walla Walla, Washington, 16.

67. Deutschmann, "Federal City," 21.

68. United States Bureau of Census [hereafter cited as USBC], United States Census of Population: 1950, vol. II, Characteristics of the Population [cited hereafter as 1950 Characteristics of the Population], Part 47, Washington (Washington, D.C., 1952), 44, table 11; USBC, United States Census of Population: 1960, vol. I, Characteristics of the Population [cited hereafter as 1960 Characteristics of the Population], Part 49, Washington (Washington, D.C., 1963), 91, table 32; EBS Management Consultants, Inc., Comprehensive Plans for the Urbanizing Areas of Benton County, Washington, Prepared for the Benton Regional Planning Commission (San Francisco, 1965), 106.

69. EBS, Inc., Comprehensive Plans for the Urbanizing Areas of Benton County, Washington, 107; Deutschmann, "Federal City," 173, 301-302.

70. JGT, Master Plan for Richland, Washington, 4, 38.

71. AEC, "Report of the Safety and Industrial Health Advisory Board," 5, 20; EBS, Inc., Comprehensive Plans for the Urbanizing Areas of Benton County, Washington, 105; "Interview with Betty Jacobs," 22.

72. JGT, Master Plan for Richland, Washington, 4, 21.

73. JGT, Master Plan for Richland, Washington, 4; Deutschmann, "Federal City," 135-38; Richland: The Atomic City (Richland, GE Community Operations, 1958).

74. U.S. Housing and Home Financing Agency, "A Commercial and Industrial Survey of Richland, Benton County, Washington," 5; USBC, 1950 Characteristics of the Population, Part 47, p. 43, table 10; USBC, 1960 Characteristics of the Population: 1960, Part 49, p. 92, table 33.

75. Minutes of RCC, May 27, Nov. 4, 1957, FCP.

76. The (Portland) Oregonian, Sept. 9, 1947; Charles E. Benton cited in JCAE, Disposal of Government - Owned Community at Richland, Wash., 59-60.

77. On the difficulties of recruiting in California, see HWMR 1/48, p. 108; HWMR 5/48, p. 123. On prospective secretaries' fears of "pioneering" in south central Washington, see SSR, Oct. 17, 1954. On the battle for Denver, see Jack Curts, memo, June 26, 1947, MRCF-ACC, Box 45.

78. Sanger, Hanford and the Bomb, 40.

79. Richland Day brochure, 1947.

80. Atomic Frontier Days: A New Light on the Old Frontier, Richland, Washington, Sept. 4-5-6, 1948 (Richland: Junior Chamber of Commerce, 1948); Richland--Richland, Washington: A Key City of the Atomic Age; 2nd Annual Atomic Frontier Days (program) (Richland, 1949), 9, cover.

81. Richland Welcomes You! The Atomic City (Richland, 1958: RPL-CF-Richland-Description-Guide Books), 1; 2nd Annual Atomic Frontier Days, 3.

82. HWMR 6/52, p. L-1.

83. Bekins Moving & Storage Co., Map of the Tri-Cities, Kennewick, Pasco, Richland, Washington (Kennewick, 1958?).

84. Comment from Governor Albert Rosellini, cited in Richland Commencement Day Souvenir Program (Richland, 1958; RPL-CF-Richland-Commencement Day file). See also Abbott, "Building the Atomic Cities"; Glenn T. Seaborg, "Large-Scale Alchemy--25th Anniversary at Hanford--Richland," AEC press release, June 7, 1968, FCP.

85. Minutes of RCC, May 11, 1953, FCP.

86. JCAE, Disposal of Government-Owned Community at Richland, Wash., 59-60, 89-90.

87. TCH, Feb. 19, 1950. See also Ted Van Arsdol, Tri-Cities: The Mid-Columbia Hub (Chatsworth, Calif., 1990).

88. EBS, Inc., Comprehensive Plans for the Urbanizing Areas of Benton County, Washington, 43.

89. USBC, United States Census of Population: 1950, Vol. 2, Characteristics of the Population, Part 47, Washington (Washington, D.C., 1952), 8, 43, 44, 67; USBC, United States Census of Population: 1960, Vol. 1, Characteristics of the Population, Part 49, Washington (Washington, D.C., 1963), 23, 45, 46, 91, 132; USBC, United States Census of Population: 1970, Vol. 1, Characteristics of the Population, Part 49, Washington (Washington, D.C., 1973), 13.

90. USBC, United States Census of Population: 1950, Vol. 2, Characteristics of the Population, Part 47, Washington, 43, 44, 74; USBC, United States Census of Population: 1960, Vol. 1, Characteristics of the Population, Part 49, Washington, 91, 92, 134.

91. USBC, United States Census of Population: 1950, Vol. 2, Characteristics of the Population, Part 47, Washington, 43,

71; USBC, United States Census of Population: 1960, Vol. 1, Characteristics of the Population, Part 49, Washington, 92, 134, 135, 137, 139, 140.

92. Charles P. Larrowe, "Memo on the Status of Negroes in the Hanford, Washington, Area," April 1949, pp. 3-4, LP, Box 6.

93. Larrowe, "Memo on the Status of Negroes," 3-4.

94. AEC, "Negro Relations in the Atomic Energy Program," AEC 412, March 7, 1961, 47-51Sec, 1, 2, 4.

95. R.W. Cook and Oscar S. Smith to W.W. Boyer, April 22, 1953, in "Community Management--Racial Relations" file, 51-58Sec.

96. S.L. Sanger, Hanford and the Bomb: An Oral History of World War II (Seattle, 1989), 87-91.

97. USBC, United States Census of Population:1960 (?).

98. TCH, May 19, 1966, clipping on file in Eells Northwest Room, Penrose Library, Whitman College, Walla Walla, Washington.

99. William G. Greenfield to Henry M. Jackson, HMJP-3, 112:26; "Interview with Melvin Jacobs, Class of 1939," by Peggy Corley, March 19, 1990, Eells Northwest Room, Penrose Library, Whitman College, Walla Walla, Washington, 17.

100. JGT, Master Plan for Richland, Washington, 5; Hanson W. Baldwin, "New Atomic Capital," New York Times Magazine, July 30, 1950, p. 19; Deutschmann, "Federal City," 289-93; HWMR 1/48, pp. 141, 208.

101. Hanford Atomic Products Operation, G.E., Richland, Wash., to HAPO Recipients of Community Leader Mail Survey, Oct. 28, 1957, FCP; R. A. Stafford, "The Reality of An Atomic Utopia: The Town Without a Past," Intellect 104 (December 1975):228.

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CHAPTER THREE

A Culture of Production:

Hanford's Nuts and Bolts, 1945-1963

Beginning in the Manhattan Project, and during the twenty years following it, Hanford's work and role were defined by its production reactors. These building-sized machines stood at the center of a culture of production, one dedicated to turning out plutonium, a vital material in the schemes for America's postwar defense. Hanford's first eight reactors were graphite and water-moderated, water-cooled uranium piles; they were recognized by the end of World War II as dead ends in terms of the development of nuclear reactor technology. But they remained throughout the Cold War as cost-effective, reliable sources of plutonium, and ironically the U.S. strategy of a high-technology defense mandated that Hanford stick to a relatively low-technology method of producing plutonium. Even through the construction of Hanford's last plutonium producing reactor (the N, which became a dual-purpose facility with the construction of an electricity generating station in 1963-1966), the Atomic Energy Commission's installations at Hanford centered on efficient production rather than on leading-edge reactor designs.[1]

The move west from Chicago to the Columbia River site in 1943 put the nuclear technology pioneers in the center of what had long been considered a canvas for development, in particular large-scale development under the aegis of large corporations or

the federal government. Railroads, irrigation systems and hydroelectric networks, forestry and mining were planned as, or developed into, elaborate engineering monuments in the West. At the end of World War II, the government's wartime coordinator of research and development termed science "the endless frontier"[2] -- a crucial territory which America had to colonize and develop relentlessly, the territory of radar and computers, of guided missiles and nuclear weapons. In the eyes of many, the boundaries of the frontier were pushed back by scientists at sites such as the AEC's Los Alamos Scientific Laboratory, a facility properly managed by a university, rather than by an industrial contractor.

According to this view, somewhat behind the frontiers of science were installations such as the Hanford Works, a production facility where the insights of science were deployed, properly managed by an industrial contractor -- after 1946, the General Electric Company. Hanford after the war ran not on Nobel-level scientific genius, despite the fact that it centered around the mysterious power of the atom. It ran instead on another kind of intelligence. To understand the real character of the practical knowledge extended and developed at Hanford, it is useful to look briefly at the nuts and bolts of the three generations of postwar piles created to increase the output of plutonium for the Cold War. This knowledge, again, was technological rather than scientific, and had to as much with hands-on skill as with theory.

Like most technologies, this one was developed by learning the secrets of judicious banging on the pipes. "Anyone who has visited these plants knows that they are extremely difficult situations," one Congressman reminded his colleagues on the Joint Committee on Atomic Energy in 1949. "They are steamfitters' and plumbers' nightmares....the ultimate of laboratory experimental devices....[the Redox separation facility] is the damnedest thing you ever saw in your life, with pipes and things running all through the thing."[3] Plumbers and steamfitters are not the craftsmen usually associated with experimental devices, a fact which points to the essential character of Hanford's technology: while in the mind it was associated with the mysteries of nuclear physics, in the field it was manipulated in terms of material nuts and bolts.

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Hanford's reactors, too, were complicated plumbing systems, large stacks of graphite bricks with holes drilled through them to admit a battalion of water pipes. The pipes held the small cans of uranium which fueled the reactor, and also provided cooling water which carried off the heat of reaction. While the aluminum walls of the fuel elements held the fission fragments produced by uranium fission, and only a small part of the radiation was then released into the cooling water supply, the reaction's heat passed directly out to raise the water's temperature.[4] Much of the expense of constructing and operating the reactors, and the difficulty of maintaining them, came from

running a reliable supply of treated cooling water through the plumbing system, monitoring its flow, and determining the most effective pressure and flow rate at which to provide water to the system.

Both to keep the reactor's heat within manageable limits, and to allow the easy passage of fuel elements, it was vital to keep the pipes clear. Despite water treatments, some sediments could still appear in the pipes, and wartime operators developed a simple expedient to scour out the plumbing. Borrowing a Model 1903 Springfield rifle from the Army, the Hanford staff sawed off the barrel and welded on a flange which bolted over the end of a partially blocked reactor pipe. The pipe could then be cleared by the direct method of firing a blank charge into it and using the expanding gases from the charge to blast out the sediments.[5] Using a .30 caliber rifle to make delicate adjustments on an advanced piece of nuclear technology is not Nobel-winning stuff, which makes the point that this is a technology which should be thought of in terms of crow bars and sledge hammers at least as much as slide rules and electronics.

Clearly, during the war it was expected that such direct measures were to be taken in order to keep the project moving ahead. Hanford's whole construction was dictated by the belief that speed was of the essence, that time was more important than money, and that all other considerations were secondary to ending the war. By 1947, the beginnings of the Cold War convinced planners that they could not afford to take the veteran piles out

of production without replacing them with new ones. Plutonium was a vital raw material used to hold America's strategic advantage, forestalling the Soviet Union and allowing the demobilization of millions of servicemen who were eager to be separated from the military.

Thus Hanford's reactors had to be transformed from the products of a crash project into stable plutonium factories and permanent parts of the defense infrastructure. During the war, Hanford was built as "temporary, emergency" facilities, lagging behind the uranium-235 separation plants at Oak Ridge which "had been transformed...to a stable, industrial operation."[6] Washington State's Columbia Basin Commission, destined to be disappointed by the amount of land which Hanford would permanently remove from agricultural uses, recognized in 1946 that nuclear technology could represent an important source for industrial jobs if the wartime facilities were made a permanent production installation. They memorialized AEC chair David Lilienthal: "this State needs and seeks a rapid growth of industrial enterprise....Be it therefore resolved, that the Columbia Basin Commission request the Atomic Energy Commission to carry on a major portion of its experimental activities in this State."[7] Hanford's permanence, however, came about not solely because of the white-coated "experimental activities" which naturally came to the collective mind of the CBC when it thought about the activities in which the AEC was engaged.

Historians of technology argue that analytical precision and

historical accuracy require a clear distinction between science and technology, both as activities and as bodies of knowledge, despite the common confusion of the two.[8] Postwar, science-based technologies are especially prone to being treated as scientific artifacts, and so the features best understood by treating them as technologies (with economic, industrial, and material determinant factors) are easily overlooked.[9] In the case of Hanford, it is crucial to remember that such phenomena as neutron fluxes and their interaction with moderating and fissionable materials, while esoteric, were treated as elements of a production process.

The successful maintenance and expansion of graphite reactors and separation facilites came about because of improvements developed by workers and engineers on the site. Briefing Lilienthal for a visit to Hanford, the manager of the AEC's Hanford Operations Office reminded him to praise employees for their problem-solving ability. Thanks to these talents, he wrote,

> threatened shutdown of certain production areas did not materialize due to "on the job" improvements made by regular operating personnel. The plants were built for a single wartime job, and the modifications made by plant personnel were made without production loss. The accomplishment is one of the greatest hurdles taken since the Commission took over.[10]

Indeed, this episode summarized the two main currents in the history of Hanford's production plants: steady development of graphite-moderated reactors, as opposed to the use of new reactor types, and the overriding concern with measures to avoid

producion losses.[11]

Planning on the national level throughout the Cold War emphasized the steady and increasing production of plutonium from Hanford's reactors. The Army and Navy agreed in 1947 to a postwar industrial mobilization plan which stipulated that even during peacetime, America must have the industrial capacity to immediately produce munitions at the level of peak production which had been reached during World War II. The Army and Navy Munitions Board recognized that the Atomic Energy Commission, "to cover [our] needs in the event of a major war," would have to be provided with the means of production "over and above the peak consumption of World War II." For the military, such planning meant stockpiling weapons factories and their components, preparing for the next war but winding down from the last one. The AEC was in a very different position. "We also explained that as far as our current operating program went," explained the Commission's general manager, "we were in a different position from the Armed Forces in that we are now operating at full capacity for the purpose of producing weapons."[12] Even in peacetime, then, the AEC had to be concerned with producing plutonium and other strategic materials in ever-greater quantities.

Required by the legislation which established the AEC to recommend a fissionable material production schedule to the President, in consultation with the Joint Chiefs of Staff, the Commission developed a standard phrase used yearly to set

production goals for its plants: "we recommend that you approve the production...of plutonium and uranium 235 in the maximum amounts attainable consistent with safety and good operating practice."[13] The first production plan proposed by the AEC and the military in April, 1947, was based on the belief that America's nuclear stockpile was "not adequate to meet the security requirements of the United States....[A]llocation for purposes other than the fabrication of atomic weapons should be limited to essential research."[14] Fissionable materials set aside for research and development were held ready for coversion into weapons in case of emergency.

Even when the AEC was able to exceed its planned output of weapons fuel, it fell behind the demands of an ever-more threatening world situation as perceived by military planners. "The accumulated total number of bombs expected to be on hand January 1, 1950 will be ahead of the scheduled requirements for that date," the AEC chairman and the Secretary of Defense reported in April, 1949. "However, from an analysis based on the Eniwetok tests, and from a continuing consideration of the critical international situation, the Joint Chiefs of Staff express a strong view that the current objective...is inadequate." Taking into account these concerns, particularly the call of the Joint Chiefs for a greater number of nuclear weapons in the U.S. arsenal, Truman was asked to approve an increase in production goals and the acquisition of plutonium and fissionable uranium in the greatest quantities possible.[15]

Even a scheduled short-term loss of five per cent of Hanford's plutonium production capability, planned to make use of some of the space in the reactor for materials tests to gather data for future reactor designs, brought the commissioners a warning from the AEC general counsel that they ran the risk of violating the plan which called for the maximum practicable output.[16] Throughout the period of reactor construction at Hanford, planners, especially the members of the Joint Committee on Atomic Energy, held it as an article of faith that there was no such thing as too many nuclear weapons in America's stockpile. Thus, Hanford's role as a production site was fixed, by its position as an arm of the Commission's Division of Production (as opposed to the Division of Reactor Development) and by the tremendous demand for its basic product.

The very importance of plutonium, and its scarcity relative to demand, imposed a set of conditions which limited the use of Hanford's plants and reduced the possibility of an expansion of Hanford's mission after World War II. During the war, cost-efficient, assembly-line methods of casting uranium fuel elements for the reactors were set aside in favor of more expensive extrusion techniques, because the Manhattan Project's management could not delay plutonium production to allow test of the cast slugs in Hanford's piles.[17] After the war, financial concerns were a more important issue, but not the ruling one. For example, Hanford failed in a bid to take a substantial role in reactor development by providing space in its reactors in which

material samples could be subjected to neutron bombardment, and so tested for their suitability for use in reactor designs. In addition to the neutron flux of its reactors, which could be used as readily for materials tests as plutonium production, Hanford had to offer its hard-won experience at the operation of reactor programs under real-life conditions.[18] But under the program adopted by the AEC, the "backbone of reactor development" comprised four reactors to explore advanced technological options. GE would attempt to build an intermediate-energy, neutron-driven, breeder reactor, but in New York, not Washington; Hanford's neutrons would not be devoted to research uses to any great extent, but dedicated rather to production of plutonium.[19]

Instead, the Materials Testing Reactor was built at what became the Idaho National Engineering Laboratory, under the sponsorhip of the Commission's experimental arms at Argonne and Oak Ridge. Construction began in the autumn of 1949; by the following summer, "both Argonne and Oak Ridge, even with the help of experienced architect-engineers, were discovering that building reactors was not an ordinary type of construction activity," and the reactor went critical for the first time on March 31, 1952.[20] The Materials Testing Reactor was designed to be used by researchers and for research; a secondary group and a secondary function at Hanford, as its role was defined by the AEC. The same spring that Hanford's AEC managers asked to take a role in materials testing, the AEC had determined that even

within General Electric, reactor research and plutonium production were "essentially different" and best managed under separate contracts, one covering GE's activities in Washington state and the other covering operations at GE's Knolls Atomic Power Laboratory in New York.[21] Such contracts made possible the AEC's work through the "artificial hands" of "non-governmental organizations," academic and industrial, and defined the proper limits for those organizations' endeavors.[22]

A production facility such as Hanford was defined not only by policy, but by the kind of professionals deemed appropriate to work there. At Hanford, the AEC and GE between them in 1947 employed 91 chemists and 9 metallurgists, as opposed to 28 physicists; there were 104 chemical engineers working on the Columbia along with 52 electrical engineers, 65 mechanical engineers, and 36 civil engineers.[23] It was professional workplace dominated by engineers rather than scientists, and, among the scientists, by the most industrially-oriented disciplines.

The editors of the journal Nucleonics, who sought to encourage the development of an industry based on nuclear technology, urged their readers to recognize the routine engineering nature of work at sites such as Hanford. "Experience...has shown that capable chemical, electrical, electronic, and mechanical engineers can acquire the small amount of nuclear physics necessary for...competence in rector design," Nucleonics editorialized.[24] Chemical engineers, indeed, were

the appropriate professionals to manage a chemical process operation, such as the production of plutonium, and, according to the industrial boosters, also take the lead in making nucleonics a profitable free-market industry rather than a ward of the state.[25] As the chair of Brookhaven's Reactor Science and Engineering Department assured readers, "the production of plutonium in a reactor while involving a nuclear transformation, usually thought to be a subtle process of nuclear physics, has the atmosphere of a water treatment plant, or an oil refinery."[26]

Hanford not only had its characteristic professionals, but also a method of operation inherited from wartime operations and appropriate for a facility dedicated to production. Graphite reactors were bulky, but reliable and efficient; a 1948 AEC analysis pointed out that for all the talk about more exotic moderators such as beryllium and heavy water, only graphite piles were in practical service, and they worked economically. As used in production reactors to produce plutonium, $55.00 worth of heavy water did the duty of only $3.50 worth of graphite.[27] In building a Hanford production reactor, the two to three thousand tons of graphite were arranged according to purity, with the best graphite going into the green zone at the pile's center, and building out to the poorest material, stacked in the peripheral red zone.[28] Operating practice also reflected this appreciation of the realities at play within the reactor, as they were controlled by hand once a self-sustaining reaction was under

way. In order to keep the reaction running at peak efficiency throughout the pile, the operator's job was to adjust control rods to the best position for each region. "A good operator can beat a machine in maintaining the trim of a pile, particularly a big one like [Hanford's], where the neutron flux may behave quite unpredictably at times, sometime making the operator think he is operating several small reactors in parallel from the same set of controls."[29] The piles were not run by theory, nor by automatic controls or feedback circuits, but by hands-on knowledge.

This practical insight was required immediately after the war to keep Hanford's reactors in operation. The central question concerning Hanford which faced AEC planners at the beginning of 1947, as the Commission assumed full responsibility for the postwar operation of the Manhattan Engineering District facilities, was whether or not the wartime plants could continue to operate. An institutional question had been solved by GE's assumption of responsibility from DuPont; if Richland was there to stay, however, Hanford's production base -- its graphite-moderated piles -- would have to be repaired or replaced. What exactly determined the lifetime of a nuclear reactor? What dangers, safely ignored over a few years during wartime, had to be taken into account when planners thought in terms of peacetime decades? These questions turned on how the materials making up the wartime piles (B, D, and F reactors) responded to long-term exposure to heat and radiation, problems which the Army deferred

to Hanford's new owner, the AEC.

Of the three piles inherited by the Commission, B was held in reserve and not operating. The two operating piles, D and F, were progressively afflicted with "graphite creep," a condition which caused the graphite bricks to expand, and threatened to warp the aluminum process tubes which carried both fuel elements and cooling water through the pile. B pile was held in reserve, both to insure against a total failure in the plutonium production line, and so it could be used to produce polonium, a neutron-rich material needed to initiate the explosive fission in some postwar weapon designs.[30] By the time it was shut down, the B pile had expanded roughly two inches on a side, and the problem continued in the younger piles as long as they were run at wartime power levels.[31]

Postwar expansion plans initially assumed that all three wartime piles would have to be shut down and replaced with new reactors, which might make use of the water pumping plants already in place to serve B, D, and F; these replacement piles (BR, DR, and FR) would be supplemented by two new production reactors to increase total output, and a new chemical separation system would allow GE to gather practically all of the plutonium produced in the reactors, as well as recovering uranium for other uses within the AEC program. These projects, along with a planned new fuel fabrication plant, meant that GE was faced with a major construction program when it took over Hanford. Also, the new contractor was tasked with eliminating radioactive

contamination of the stack gas released by Hanford's processing plants.[32]

The AEC's General Advisory Committee, which provided scientific advice concerning nuclear technology to the Commission, believed that reactor technology was fundamental to the U.S. program but less problematic than the basic research into advanced weapons designs. At its first meeting, it approved of the complementary laboratory programs devoted to reactor development, one more academic at Brookhaven, and one industrially oriented run by GE in Schenectady. Again, formal research and development was not considered a function of the Hanford facility.[33] The GAC chairman, J. Robert Oppenheimer took the view that reactor development might promote the public image of nuclear technology, while eliminating a sticky policy question by making "sufficient fissionable material so that questions of allocation became relatively unimportant." An abundance of fissionable uranium and plutonium would do away with the competition between research and weapons production, and among weapons systems, created by the limited supply of basic fuel. Committee member Enrico Fermi was little concerned with the atom's public image in the face of what he regarded as the more immediate problem of America's lack of the number of nuclear weapons necessary to meet the international situation. The supply of fissionable materials should be expanded, he argued, not initially by a long-term program of reactor development, but by whatever measures might be instituted "in, say, a year's time"

in the existing plants.[34] The GAC recommended that Hanford plan to build replacement units, and to produce enough plutonium to match the uranium-235 supply in the ratio dictated by the design of composite weapons. Subjecting the production reactors' uranium fuel to a more intense neutron flux, and improving the process by which plutonium was recovered from the spent reactor fuel, were expected increase the plutonium output in the near term.[35]

Just over a year later, in April 1948, Oppenheimer and the GAC argued that the problems of increasing the neutron supply within Hanford's reactors and their plutonium output could not be considered "under the pressure of actual construction," and suggested that the research arms of the AEC and GE might undertake studies on such improvements.[36] But the solution which saved B, D, and F reactors and allowed the direct increase of Hanford's plutonium output came from work on the site.

Finding that heat reduced the changes wrought in graphite by neutron bombardment, engineers changed the atmosphere circulating around each reactor. Once most of the helium in the atmosphere surrounding the reactor was replaced with carbon dioxide, more heat was held in the graphite blocks before being carried away by the water circulating through the reactor's process tubes. With a carbon dioxide atmosphere, the D pile went from the first candidate for replacement to a model of a long-lived plant. The F pile was then used to experiment in order to find the ideal mix of the two gases, beginning with 10 per cent carbon dioxide and

increasing the concentration while measuring the effect on the expansion of the piles graphite blocks.[37] If it could be done safely and economically, running the reactors at higher power also slowed the advance of graphite creep.

To speed construction of a replacement for D reactor, the proposed DR reactor was sited nearby, where it could make use of the water pumping system already in place. At the beginning of the planning process for the replacement piles, when it seemed as though the original plants might have only two years of life left before graphite creep made them inoperable, speed and economy (a thirty per cent savings in manpower) both dictated that the first new piles should be placed next to the reactors being replaced. In the longer term, two completely new pile areas might be developed.[38]

To get the greatest output from the failing reactors and to save the supply of uranium fuel, the concentration of plutonium was increased by lengthening the exposure of fuel elements, beginning at the end of 1947. This measure required a careful management of the reactor's neutron supply, or its increase if possible, and also slowed down the rate of production. It also represented a risk to the stable operation of the reactor, because the aluminum-clad fuel elements were prone to blistering and warping under the prolonged exposure, exacerbating the difficulties already present because of the bending of process tubes in the warping piles. To combat these problems, Hanford's managers pursued improved aluminum canning methods, cut the

length of the fuel elements from eight inches to four inches, and used a technique called "segmented pushing", in which only half the fuel elements in a loaded tube were removed for processing. Under this method, one-half of any particular fuel element's time in the reactor was spent in the most intense radiation at the reactor's center, while half was spent in a "cooler" peripheral region.[39]

Though through the Commission's first year, 1947, B, D, and F seemed to be doomed, by early 1948 they had been saved by measures applied on the site, and the B pile went back into use that summer.[40] Attention then turned to continuing measures to increase the plant's output and to make the most efficient use of a limited supply of uranium fuel. In March 1949, physicist and AEC commissioner Robert F. Bacher visited Hanford (as well as Berkeley and Los Alamos) and recommended that the reactors be operated at even higher power levels to increase the speed with which plutonium could be turned out, an option which would increase Hanford's demands for uranium -- "but this can in part be met" Bacher noted, if the concentration of plutonium in each fuel element was increased. With continuing efforts to recover still-usable uranium after it had passed through the reactors and through plutonium separation operations, Bacher believed, Hanford's output could be increased substantially with only a modest demand on scarce raw materials.[41] Having saved the original reactors, Hanford's staff was then called upon to learn to operate them at increasingly high power levels.[42]

With growing experience at Hanford, continued adjustment of these variables -- the concentration of plutonium in the irradiated uranium fuel before its removal, the power level at which the reactors were operated, and the efficienices of plutonium recovery -- allowed Hanford's increasing reactor herd to be operated on essentially the same amount of fuel used to run the original three. This was vital to increasing production, as demanded by Cold War policy. "During 1948 and 1949, we are receiving the total world production of uranium," the AEC informed its Congressional overseers, "this is not sufficient [under original operating conditions] to operate five piles," as called for by Hanford's postwar building program.[43]

Even with the salvaging of B, D, and F, additional new reactors were a vital feature of postwar defense policy. Late in 1947, Oppenheimer and the GAC warned the AEC that "to delay the construction of two new Hanford reactors will mean a decrease in our effective stockpile of weapons, say some five years from now, of about 10% for each year of delay."[44] In 1948 plans for Hanford's expansion began in earnest, including consideration of the possibility of releasing some or all of the Wahluke slope lands overlooking the site from across the Columbia river, which had been originally scheduled to play an important role as irrigated croplands in the Columbia Basin project. The process of designing new replacement piles allowed for modifications of the original designs; the AEC believed that work on control systems, on graphite purity and other measures to prevent fuel

elements from sticking in the process tubes, and environmental monitoring to assess the extent of airborne and water-borne contamination from Hanford might allow some lands to be released. GE had been assigned the task of eliminating contaminants from stack gases at the processing plants, and the AEC Reactor Safeguards Committee was scheduled to visit the site in June, 1948 and make its own recommendations.[45]

At the same time, the AEC was undergoing its own process of re-examination. Production of fissionable material and concerns over the adequacy of the uranium supply were major concerns, as were the prospects of the change in administrations with the expected victory of Dewey over Truman in the November elections. The AEC's Production Division assumed an expanded importance within the organization, and the AEC manager at Hanford, Carleton Shugg, moved to Washington, D.C. as Deputy General Manager of the AEC in August, 1948, after seeing Hanford's building program well under way.[46]

Hanford's new reactors, DR and H, followed the original pattern of the wartime plants, with the proviso that any modifications "must cause no delay in the construction schedules." They made use of better purified graphite to allow the reactor to run at greater power levels, and used smaller graphite blocks around the process tubes to restrict the graphite expansion in the piles.[47] H represented a new production facility, complete with its own water works. DR's role was less clear; the salvation of the D pile meant that DR represented a

second plant in the same area with only a single cooling water system. In the spring of 1949, the AEC responded to a military request for rapid expansion of Hanford's plutonium production facility by proposing to build DR its own water system, a measure that would make use of the construction force already on the site to build the reactors.[48] This measure also drew support from the Joint Committee on Atomic Energy. Its chairman, Brien McMahon, wanted to see DR's water works built with no delay, even given the possibility that a sudden reversal of D's fortunes might lead to its retirement and make its water works available for use at DR. And Representative Henry Jackson urged the AEC to seek extra funding to pay for contruction of the DR water works and keep the construction force at Hanford working.[49]

An unanswered question about operating DR and D reactors in the same area was whether the practice ought to be ruled out on safety grounds. While research continued on methods to remove radioactive contaminants before they were expelled with stack gases from the plutonium separation facilities, efforts to expand production resulted in more contaminants being released into the atmosphere and into the Columbia River. The Reactor Safeguard Committee after its visit to Hanford drew attention to the fact that "the distribution of stack materials over the Wahluke slope and over many other areas to great distances is a cause of much concern." More strictly within the committee's brief was a concern with the consequences of running two reactors in close proximity to each other, where an incident at one might cause an

accident at the other. While the AEC had control over sufficient land to establish an exclusion zone around the piles in accord with the established rule of thumb for safety, two piles of equal power in the same place called for a zone with a radius one-and-a-half times as great.[50] And in the push for higher powers in order to increase production rates, the chances of an accident were increased even if they remained within acceptable limits. Higher power rates led to a greater incidence of ruptured fuel slugs in the piles, and increased "the possibility of the slugs swelling so rapidly as to block off cooling water flow while the pile was still at full power."[51]

These doubts were set aside in the effort to increase production in response to the Soviet atomic bomb test, detected by the U.S. on 3 September 1949. On September 26, the AEC approved construction of water works for the DR reactor, anticipating the simultaneous operation of D and DR with about a half-mile's separation. The decision involved asking the Bureau of the Budget for permission to commit over $25 million to the project in anticipation of a supplemental appropriation. Two days later the Commission reported its action to the Joint Committee, along with the decision to boost power levels at the existing Hanford reactors.[52] The H reactor was loaded with fuel the following month.

The successful salvaging of the wartime reactors and the decision to build new reactors on the same basic pattern were crucial incidents in Hanford's postwar history. By 1950, Hanford

had been established as a production site with a well-understood technology well under control. There was little question after 1948 of Hanford moving away from water-cooled, building-sized graphite-moderated piles, which reliably produced plutonium but which were largely irrelevant to the development of reactor technology in general. With Hanford's mission being the fundamental one of plutonium production, technological development at the site occurred only incrementally within the confines of a well-defined technological model. Hanford's staff demonstrated that they were able to increase production tremendously without making radical changes to their production reactors. Given the scarcity of plutonium, the demand for which only increased from the end of World War II on, through the Soviet bomb scare and the Korean War emergency, Hanford was forced to stick to improving output through tried and true methods.

But within the confines of these methods, continual tinkering with things like water treatment, plumbing connectors, quality control on graphite and fuel elements, and safety systems in anticipation of earthquakes or saboteurs, allowed the size and power of the reactors to be increased. Such learning by doing is the main means by which any technological system develops.

While radioactive pollution, monitored by tests of vegetation, river water, and soil in the region surrounding the atomic reservation, constituted a continuing concern, with increasing operating experience came increasing confidence on the

part of managers and operators that the plutonium production reactors could be managed without a catastrophic event. After the construction of DR and H, with the loss of the U.S. nuclear monopoly and the AEC's approval of a crash program to build a thermonuclear weapon and of an increasing program of weapons tests, Hanford went on to build three even larger production reactors in the early 1950s, accepting, as it had with the simultaneous operation of D and DR, an increase in the magnitude of a possible accident.

The elements of such decisions should be clearly understood. By operating reactors at higher powers, especially after 1950, Hanford accepted the risk of accidents of greater magnitude, which is not the same as accepting a greater magnitude of risk.[53] Indeed, as noted above, with greater operating experience, incremental design changes, and especially with the development of improved safety systems, in some ways safety margins increased.

At the same time, measures taken to step up production at Hanford increased not only potential risks, but also the actual hazards of the long-term release of radioactive contaminants. As this topic is dealt with extensively elsewhere,[54] we will not treat it here, except to comment that decisions about acceptable radioactive releases can be viewed as consistent with other decisions made within the context of a culture of production and the priorities of the Cold War.[55] Within that context, information about the products released by Hanford and the rates

at which they issued from the site was kept private in the interests of keeping U. S. nuclear capabilities a secret. This prevented the realization of a prediction made by a Safety and Industrial Health Advisory Board, which reported on AEC facilities in the spring of 1948. Hanford's "sins of emission" the Board believed, would "soon be public property" in the postwar period. Over-confident estimates of the problem's magnitude, the Board argued, would not stand up to scrutiny by public health authorities; neither would the MED's waste-stack building practices stand up to comparison with industrial norms.[56]

As noted above, Hanford's environmental monitoring efforts increased as part of the postwar expansion program. And the Board found that on-site safety measures for the protection of workers were laudable -- especially when the DuPont/GE program at Hanford was compared to the lax safety regime at Los Alamos, managed by and for academics.[57] But despite the Board's concern that "normally in matters of health and sanitation" an "official agency...either the municipal or state health department" would review potential hazards to the public health, and its recommendation that the AEC turn to outside consultants when evaluating off-site risks, such decisions were made internally.[58] That is, a growing commitment within Hanford and the AEC to increased production, and a growing facility with the techniques which made such increases possible, was not balanced by any independent capability to evaluate Hanford's program for

its effects on public health.

Proven productivity and construction efficiency were Hanford's strengths, overwhelming concerns about the dangers of more powerful reactors and Hanford's relatively indefensible postion close to a foreign border and, compared to other continental sites, close to the Soviet Union. Even with construction under way on two new reactors at Hanford, in the aftermath of the Russian atomic bomb Senator Brien McMahon of Connecticut, chairman of the congressional Joint Committee on Atomic Energy, was "fearful that we may not have set our sights high enough so far as quantity of output is concerned."[59] At a meeting with representatives of GE, McMahon noted that while the heavy-water moderated reactors planned by the AEC and the Truman administration would take at least four years to build, Hanford could put another graphite-moderated plant into production in one and a half. "The fact that Hanford-type piles are obsolescent and comparatively inefficient suggests the choice of heavy water reactors is the wise choice," McMahon noted. "Yet, no reason has been given for pursuing both plans simultaneously....[the former] preferably at a location other than Hanford."[60]

But no other site was so well prepared to efficiently build a pile. The site's sixth reactor, C, again followed the same basic design as had DR and H, with improvements made for a rated power level of 750 megawatts. Construction at C began in June 1951, a year into the shooting war in Korea, and operations began at the pile in November, 1952. It was placed in the same area as

the venerable B pile. As commissioner Gordon Dean informed Truman, recommending that the new large reactor be built at Hanford, the "distinct advantages to be gained in speed of construction, certainty of operability, and early delivery of plutonium at a reasonable cost are sufficient to override the potential risk of constructing this reactor at Hanford."[61] Construction of the C reactor came in the midst of a large-scale increase in the efforts of the AEC: Hanford planned to add 1,200 employees in the first six months of 1951 as the AEC's sponsored employment grew to 80,000 and then 100,000 by that fall. In terms of capital investment, the AEC ranked third among all industrial organizations, after AT&T and U. S. Steel, and ahead of General Motors.[62]

Further production increases were expected to come from two new reactors, planned to operate at greatly increased powers. The two "jumbo" reactors, designated in design studies as "X reactors" and finally titled KE and KW, were designed to operate at 1300 megawatts, about six times the wartime power of B, D, and F. Original plans calling for two more reactors on the model of C were changed as part of the AEC's second great expansion of production capability. At the beginning of 1952, the AEC directed its managers at Hanford to begin "preliminary planning, ...the development of design criteria, site location and design of two new 1300 MW reactors, [along with] separation capacity expansion and other requisite facilities."[63]

AEC planners recognized that such large reactors had

problems associated with them which had to be considered. Sited at Hanford, they would contribute markedly to the heating of the Columbia and affect salmon spawning. They also made Hanford an even more attractive target for enemy bombing, and the Department of Defense recommended that they be dispersed at least two miles apart even if Hanford itself could not be dispersed in accord with the plans laid for much of America's vital industry. Defense planners also realized that siting the reactors close to the river left them open to danger from flooding; if enemy action destroyed the Grand Coulee Dam upstream, the resulting flood would destroy everything less than forty feet above the normal river level at Hanford. Finally, the Reactor Safeguard Committee formula, which suggested a safety radius in miles determined by the figure one percent of the square root of the kilowatt power output of the reactor, called for an increase in the land held across the Columbia and discouraged operation of two jumbo reactors at a single site.[64]

All these worries were important, but ultimately less important than the rapid, economical construction of KE and KW. The Hanford Operations Office, taking into account the concerns listed above, recommended siting the two reactors in one area, close to the river, and discounting the possibility of a simultaneous accident in computing the safety zone required around the site. The AEC agreed; commissioner Henry Smyth argued that "the most important consideration was time, and that he favored the the present twin-area plan rather than lose nine pile

months of production for further insurance factors."[65] KE and KW were built midway between two other twin reactor sites, B/C and D/DR, and provided "plutonium at a cost which is unlikely to be improved upon by any other reactors, which, at the moment, are designed to a point where construction could begin." Compared to the H reactor, each of the jumbos was a third again as big, held half again as many process tubes for uranium fuel, and ran with greater efficiency in terms of water and manpower used to produce a given amount of plutonium. The AEC was forced to consider how it might have to justify construction of the more advanced and more expensive heavy-water moderated production reactors scheduled to be built at Savannah River, which it did on the grounds that Hanford's graphite piles were inefficient users of neutrons, while the heavy-water piles provided an abundant neutron supply necessary for producing tritium, a fusion-weapons component.[66] Construction of the jumbos began within four months of the Commission's siting decision, and both reactors began operation during the first quarter of 1955.

Some of the heat generated by KE and KW was even used to warm the buildings which housed them, thus fulfilling some of the long-standing hopes of nuclear power boosters who had agitated for the technical means and legal permission to transfer atomic technology from government to private industry. As noted above, the editors of Nucleonics argued that, left in the hands of experienced engineers, the use of atomic piles as heat engines for electrical generating stations was a simple problem, an idea

rebutted by those with more realistic experience.[67]

While Hanford's reactors operated at ever higher powers after 1949, they seldom operated at temperatures sufficiently high for steam power generation. As the water in Hanford piles' process tubes served as a secondary moderator, turning it directly into steam would lower its neutron absorption, leading to instabilities in the chain reaction. By putting the water in the pipes under a pressure of 3206 pounds per square inch, the water could be prevented from turning to steam and superheated water could be run through a heat exchanger to provide steam for a generating plant, but such pressures would require beefing up the tubes themselves, again interfering with the dynamics of the reaction. And in turn, the higher temperatures would cause the degradation of the aluminum itself, again threatening the integrity of the process tubes as well as the mechanical strength of the whole pile -- a difficulty which could be met with additional structural support, if it were known how the braces would behave under neutron bombardment and how the pile would respond to the presence of the new material.[68] These interlocking problems were so complex that Hanford did well to buy its electricity (either in the form of coal or from the Bonneville Power Administration) and stick to the production of plutonium alone.

Still, the business advocates saw dual-purpose reactors, designed to produce both plutonium and electrical power, as the point of entry for private enterprise into the nuclear arena.

They argued that the legally-mandated monopoly held by the federal government over fissionable materials should not extend over all of nuclear technology as well. Given sufficient attention to the technical problems, and given the fact that production piles naturally produced heat along with plutonium, co-generation schemes seemed like an obvious way to bring the atom into the electricity marketplace. Under such a scheme, a private company would build a reactor and power generating station, and the federal government would lend uranium for reactor fuel. After the uranium passed through the reactor, the government would retrieve it, process it to extract plutonium, and then pay the operating company for the plutonium while outside customers paid for electricity.[69]

But while Hanford produced plutonium according to a government plan, how could plutonium producers have confidence in the existence of a market for their wares? Following the lead of the head of the Joint Committee on Atomic Energy, Brien McMahon, in 1952 committee member Henry Jackson agreed that "there is no such thing as 'enough' atomic bombs....This means that industrial firms which build dual-purpose nuclear reactors have an unlimited market for the plutonium they produce."[70] Four years later, using the same argument, Jackson brought plans to the Senate floor to force a reluctant AEC to build a dual-purpose reactor at Hanford. The "new production reactor," or N, with its cooling water pipes run under greater pressure to allow electrical generation as well as plutonium production, was funded for

planning purposes in 1957 and for construction in 1958. (An electrical generation facility was added beginning in 1963, and the plant went finally began turning out plutonium in 1964 and electricity in 1966.)

While the AEC opposed a "kilowatt race" which might mortgage the long-term rational development of reactor technology in order to compete in the short term with empty achievements overseas, in 1956 Senator Albert Gore (of the Tennessee River valley) and Jackson (of the Columbia River valley) insisted that government should take the lead in building a range of prototype plants, including a model built on the Hanford graphite-moderated model. The reactor development leader Walter Zinn, retiring from Argonne, noted that the Hanford reactor type had been overlooked by industry, but might be an option for the economical production of electricity, since it certainly represented a well-understood technology. And a continuing series of studies showed that a dual-purpose reactor at Hanford would produce plutonium at a lower cost than a single-purpose production pile, although also at a slower rate.[71]

The role of the N reactor in Hanford's diversification efforts is discussed in the next chapter. The point to be made here is that Hanford's essential strength in the debates over the N reactor, as it had been throughout the postwar period, was its ability to reproduce a basic technology, the graphite-cooled pile, reliably to meet the requirements of nuclear policy. Through a process of steady incremental change, plutonium output

from Hanford increased to meet the demands of Cold War policy. Hanford was hardly ever the first choice of any policy maker when it came to investing money, and it partook of very little of the glamor of the intellectual frontiers of nuclear research and development. There was nothing exotic about Hanford's piles, compared to the other options for reactor designs pursued throughout the 1950s. Their operators had experience going back to the wartime technique of solving a production problem by bolting a rifle to the end of a process tube. Hanford's piles were usually the cheapest, and most reliable; they backed up more advanced designs, and represented a steady base of plutonium production. As a well-known quantity, the graphite-moderated reactors even allowed the AEC to accept greater risks in terms of siting the piles or operating them above their rated powers in order to speed production.

Even when Hanford's construction projects went badly over budget, as some of the first ones did in the first expansion effort of the late 1940s, the rapidity with which one of these standard piles could be put into production was a source of confidence. Pressed to speed up plutonium production in the aftermath of the Soviet atomic bomb tests, the AEC argued to the Joint Committee on Atomic Energy that its contractors ought to be allowed to begin construction on a project when planning for it was only 20 percent complete, rather than 80 percent as policy then insisted. Contractors would certainly go over budget, as GE had already done on its Hanford projects, although they would

derive no benefit from it under a cost-plus-fixed-fee repayment schedule. Senator Eugene Millikin asked if the government would not want contractors to think things through and do a better job. Replied the AEC's production director, "Well, you would, Senator, if you left out time. Now, time is the only thing, and if it wasn't for time I wouldn't be talking here at all."[72] If it wasn't for time, the AEC would have probably turned its back on Site W after World War II. Under continually increasing pressures to turn out plutonium, it invested heavily in Hanford's culture of production.

NOTES TO CHAPTER THREE

1. To place the developments discussed in this chapter more fully in the context of policy changes and the AEC's institutional development, see also Richard G. Hewlett and Francis Duncan, A History of the United States Atomic Energy Commission, Vol II: Atomic Shield (University Park, PA, 1969), ch. 5, 7, 12, 16, 17; Roger M. Anders, ed. Forging the Atomic Shield: Excerpts from the Office Diary of Gordon E. Dean (Chapel Hill, N.C., 1987), esp. pp. 3-33; and History Associates Incorporated, "Production Reactors: An Outline Overview," (Oct. 1992, DOE/NP/00092T-H1).

2. Vannevar Bush, Science -- The Endless Frontier (Washington, D.C., 1945).

3. "Hearings: Reaction to Russian Atomic Development," 28 September 1949, p. 42-43, Joint Com 5312:5.

4. Clark Goodman, "Nuclear Principles of Nuclear Reactors," Nucleonics 1,3 (Nov. 1947): 24-25.

5. This artifact is preserved at Hanford, and displayed at the B reactor.

6. AEC 1140, "History of Expansion of AEC Production Facilities," 16 August 1963, p. 2, 58-66Sec, I&P/14:"History".

7. Columbia Basin Commission to Lilienthal, 30 December 1946, LP, box 6.

8. Most writers root these arguments in particular contexts and then generalize them, for example, Edwin Layton, "Mirror Image Twins: The Communities of Science and Technology in 19th-Century America," Technology and Culture 12 (1971): 562-580. For more general discussions, see George Basalla, The Evolution of Technology (Cambridge/New York, 1988), ch. 2, and John M. Staudenmaier, Technology's Storytellers: Reweaving the Human Fabric (Cambridge, Mass., 1985), ch. 3.

9. George Wise, "Science and Technology," Osiris (ns) 1 (1985):229-246.

10. Fred C. Schlemmer to David Lilienthal, nd (c. 1948), LP box 6.

11. For a general overview of the AEC production reactor program, see HAI, "Production Reactors" (cit. n. 1), 1-21.

12. Walter J. Williams to Manager, Hanford Directed Operations, "Subj: Industrial Mobilization Plan," 14 October 1947, and Carroll L. Wilson to Williams, 17 September 1947 (attached), PRR accession number 8921.

13. Lilienthal and James Forrestal, Secretary of Defense, to Truman, 16 March 1948, 47-51Sec, 4927:9.

14. Patterson (Secretary of War), Forrestal, Lilienthal, and Leahy to Truman, 2 April 1947, 47-51Sec, 4927:9.

15. Lilienthal and Louis Johnson to Truman, 6 April 1949, 47-51Sec.

16. AEC minutes, meeting of 30 August 1949, 47-51Sec 1234:28. See also, Carroll L. Wilson to Fred C. Schlemmer (manager, Hanford Operations Office), nd (1949), authorizing use of Hanford reactors for "testing of reactor materials, providing such use does not entail a loss in plutonium production greater than 5% of total annual production."

17. W. E. Kelly, "Cast Fuel Rods," (letter to the editors), Nucleonics 15, 2 (February 1957): 123.

18. "Atomic Energy Commission: Materials Testing Reactor," AEC 149/2, 20 June 1949, 47-51Sec 1207:13. The reactor developer's ideal source of neutrons was one which delivered them at a higher energy and in a more intense and controllable flux than would be possible in Hanford's production piles.

19. "Nucleonic Events: Bacher Outlines AEC Nuclear Reactor Plans," Nucleonics 4, 3 (March, 1949): 72-73. This announcement followed one by GE which located its Hanford operations in a division separate from the one which would operated the Knolls Atomic Power Laboratory for the AEC; see Nucleonics 2,6 (June 1948): 79.

20. Hewlett and Duncan, Atomic Shield, 1947-1952, pp. 495-496, 515.

21. "Atomic Energy Commission Relations with the General Electric Company," AEC 196/1, 4 April 1949, pp. 4,5; 47-51Sec 1207:3.

22. "Report of the Advisory Board on Relationships of the Atomic Energy Commission with Its Contractors," 12 June 1947, p. 2, LP, box 4.

23. "Prof[.] Personnel, Hanford Engineer Works," 25 July 1947, MRCF-ACC, box 45, "Experts" file.

24. "Nucleonics Editorial," Nucleonics 2,6 (June 1948): 2.

25. "Nucleonics Editorial: Chemical Process Industries and Nuclear Energy," Nucleonics 3,4 (Oct. 1948): 69-70.

26. L. B. Borst, "Engineering Opportunities in Atomic Energy," Nucleonics, 5,6 (Dec. 1949):66-70; quotation from p. 67.

27. "Summary, from standpoint of control, of the Graphite Situation," 21 June 1948, pp. 6-7, 47-51Sec, 1225:6.

28. "Summary...of the Graphite Situation," ibid., p. 8. Loading by zones was another technique that went back to wartime practice, when the reactor builders differentiated between raw materials as they were placed in the pile, and especially between uranium fuels of different enrichment levels. F. A. Valente, "100 Area Engineering Notes," notes for 26 August 1944. MED 1004, PRR acc. no. 10191.

29. H. E. Hanthorn, "Hanford History, Technology, Expansion and Present Efforts," 24 June 1957, HW 51188, Accession number 7917, PRR.

30. Minutes, Executive Session, JCAE, 10 March 1949, p. 3; 47-51Sec 5312:2.

31. Harry E. Skinner to S. L. Brown, 28 June 1946, "Hanford Physical Data," MRCF-DF, Box 42.

32. "Report on Building Project 234-5, Hanford, Washington," 6 June 1949; 47-51Sec 1234:33.

33. Minutes of first GAC meeting, 3-4 January 1947, p. 5, EHC. GE's Knolls Atomic Power Laboratory was the result of a commitment made by the MED in negotiations to bring GE to Hanford in place of DuPont; KAPL "had been promised when [GE] had agreed to take over the operation of the Hanford plant" by Leslie Groves. Hewlett and Duncan, Atomic Shield, p. 16.

34. Minutes of General Advisory Committee second meeting, 2 February 1947, p. 3, EHC.

35. Minutes of the second GAC meeting, 3 February 1947, p. 10, EHC. The amount of plutonium in each fuel element could be increased by the length of time the element was exposed to radiation within the reactor. However, the plutonium itself captured some of the neutrons required to continue the chain reaction (by leading to continuing fission of uranium-235) and to cause the transformation of uranium-238 into plutonium-239. Thus lengthening the time of exposure, as well as the power level at which the reactor was operated, had to be considered with the economies of uranium fuel and neutron budgets in mind.

36. Oppenheimer to Lilienthal, 26 April 1948, attached to minutes of the ninth meeting of the GAC, 23-25 April 1948, EHC.

37. "Division of Production -- Monthly Status and Progress Report, December 1948", p. 3, Prod. 74:18; minutes, executive session of JCAE, 10 March 1949, p. 4, 47-51Sec 5312:12; "Operation of Hanford Piles at Higher Power Levels," attached to Carleton Shugg to Brien McMahon, 25 July 1950, 47-51Sec 4944:412.14.

38. Draft minutes, fifth meeting of the GAC, 28-29 July 1947, 47-51Sec 1217:GAC Minutes.

39. AEC report extract, 1-15 November 1947, "Commission Action," 12 November; "Operation of Hanford Piles to a Higher G/T Level (Revision)," 19 November 1947, both in 47-51Sec 4944:8. See also, "Production -- Monthly Status and Progress Report, February 1948," 18 March 1948, Prod 74:18.

40. Carroll L. Wilson to J. R. Oppenheimer, 16 April 1948, GenMan 5580:17.

41. Robert F. Bacher, memo to Carroll L. Wilson, 3 March 1949, 47-51Sec, 4941:411/3. Mentioned without citation, Hewett and Duncan, Atomic Shield, p. 179.

42. The quantity used for measuring the exposure of uranium within the reactors in the course of its transformation into plutonium was the Megawatt-Day (MWD). By increasing the power level to a greater number of megawatts, the same amount of plutonium could be produced in a smaller number of days.

43. Minutes of executive session of the JCAE, 10 March 1949, p. 17, 47-51Sec 5312:2; see also p. 9, 11, 13 for discussion of important elements of the Hanford expansion program.

44. Oppenheimer to Lilienthal, 28 November 1947, Report on seventh GAC meeting, 21-23 November; 57-51Sec 1212/GAC.

45. Lawrence H. Bayer to J. A. Derry, 10 February 1948, GenMan 5580:17.

46. "Nucleonic Events: Power Lag Produces AEC Reorganization," Nucleonics 3,4 (Oct. 1948): 77-78; Hewlett and Duncan, Atomic Shield, pp. 172-178.

47. Carroll L. Wilson to AEC commissioners, 21 April 1948, "Design Modifications in New and Replacement Piles at Hanford," GenMan 558:17.

48. Minutes of executive session, JCAE, 10 March 1949, p. 2; 47-51Sec. AEC 217/1 "Construction of a Water System for Pile DR at Hanford (Revision)," 23 June 1949, 47-51Sec 1235:6.

49. Minutes, General Business Meeting, JCAE, 26 July 1949; 47-51Sec 5301:26.

50. E. F. Miller to files, 14 June 1949, "Reactor Safeguard Recommendations for H.W. Pile Operations," Prod 4:17.

51. "Hanford Operations Office: The Wahluke Slope -- Secondary Zone Restrictions," nd, c. August-October 1951, p. 23, GenMan 5440:7.

52. AEC 217/3, 5 October 1949, 47-51Sec 1235:6; Anders, ed., Forging the Atomic Shield, pp. 38-40; minutes, JCAE hearings, "Reaction to Russian Atomic Development," 28 September 1949, pp. 10, 15, Joint Com 5312:5.

53. But on this issue, see also Ian G. Barbour, Technology, Environment and Human Values (New York, 1980), esp. pp. 74-76.

54. Michele Stenehjem Gerber, On the Home Front: The Cold War Legacy of the Hanford Nuclear Site (Lincoln: University of Nebraska Press, 1992). Daniel Grossman, "Plutonium and Public Health," paper presented to conference on the Atomic West, September 1992. These sources lay out the basic chronology of releases from Hanford, but they are limited. A straightforward accounting of Hanford's environmental impact and its human costs, as much as these can be measured, will be the products of a group of epidemiological studies currently under way.

55. In November of 1948, for example, GE proposed increasing the time allowed for extraneous fission products to decay in irradiated uranium before processing, in response to a decrease in the radioactive iodine tolerance level stipulated by the National Committee on Radiation Protection. But the AEC manager on the site recommended disapproval of the measure, and the Division of Production agreed. Fred C. Schlemmer to Walter J. Williams, 5 November 1948; Williams to Schlemmer, 17 November 1948.

56. "Report of the Safety and Industrial Health Advisory Board," 2 April 1948, 47-51Sec:"Health and Safety Program", p. 64. The Board also believed that assumptions about the Columbia's dilution effect on wastes and the ability of the soil at Hanford to hold wastes away from the water table were largely untested.

57. "Report of Safety and Industrial Health Board," ibid., pp. 35, 44-45.

58. "Report of Safety and Industrial Health Board," p. 73, and principal recommendation 5, np. On the specific issue of radioactive contamination of the Columbia, local authorities were consulted; see above, ch. 2, n. 57.

59. Hearings of the JCAE, "Reaction to the Russian Atomic Bomb Development," 28 September 1949, p. 50, Joint Comm 5312:5. The statement quoted is from a letter McMahon wrote to President Truman, which he read into the record at the hearing.

60. Minutes, JCAE conference with GE, 22 June 1950, Joint Com 5302:4.

61. Gordon Dean to the President of the United States, 6 February 1951, Prod 4:22.

62. Nucleonics 8,1 (January, 1951): 88; Nucleonics 9,1 (July 1951): 81.

63. On construction of more C-types: David F. Shaw (manager, Hanford Operations Office), "Expansion of Hanford Works Facilities," 30 June 1951, Prod 4:22. On planning for jumbos, R. W. Cook (director, Division of Production) to Shaw, "Expansion at Hanford," 20 February 1952, 51-58Sec 1282:10. The AEC's original plan for the expansion of plutonium production called for six new production reactors, three to built at Hanford and three at Savannah River.

64. "Location of Reactors at Hanford," June 1952, 51-58Sec 1282:10.

65. Minutes of 709th AEC meeting, 11 June 1952, p. 4, 51-58Sec 1282:10. See also Roy B. Snapp to R. W. Cook, 24 June 1952, "Commission Action on Location of Proposed Reactors at Hanford," 51-58Sec 1282:10, and "Location of Reactors at Hanford," 25 June 1952, summarizing proposals by Hanford Operations Office and the Commission's response, also in 51-58Sec 1282:10.

66. On the details of the site for KE and KW, and their physical characteristics, see "Characteristics of the Jumbo Reactors," 19 August 1952, 51-58Sec 1282:10. The quotation on their cost efficiency is from W. H. Zinn to A. Tammaro, 16 July 1952, attached to "Evaluation of Hanford 'X' Reactors," 28 July 1952, 51-58Sec 1282:10.

67. Ward F. Davidson, "Some Design Problems of Nuclear Power Plants," Nucleonics 5,5 (Nov. 1949): 4-15.

68. Davidson, ibid., p. 11.

69. Charles Allen Thomas, "What Are the Prospects for Industrial Nuclear Power? Good -- Here's a Plan to Consider," Nucleonics 6, 2 (Feb. 1950): 73, 77-78. Also on dual purpose reactors from the point of view of industry, see C. G. Suits, "Power From the Atom: An Appraisal," Nucleonics 8, 2 (February, 1951): 3-9. On the legal and economic restrictions, see Bennett Baskey, "The Atomic Energy Act and the Power Question," Nucleonics 10, 10 (October, 1952): 10-13. On the broader policy argument, Chauncey Starr, "The Role of Multipurpose Reactors," Nucleonics 11, 1 (January, 1953): 62-64, and Carroll A. Hochwalt and Philip N. Powers, "Dual-Purpose Reactors: First Step in Industrial Nuclear Power Development," Nucleonics 11, 2 (February, 1953): 10-13.

70. "The Editors Hear...," Nucleonics 10, 8 (August, 1952): 73. Cf. minutes, JCAE hearings, "Reaction to Russian Atomic Development," 28 September 1949, p. 50, Joint Com 5312:5.

71. On the pressure from Gore and Jackson, and Zinn's reaction, "Late News and Commentary," Nucleonics 14,6 (June, 1956): 17-18; on the reduced cost of plutonium under a co-generation plan, see minutes, 29th GAC meeting, 15-17 February 1952, EHC, and "Dual-Purpose Production Reactors," Nucleonics 16,5 (May, 1958): 105-107, 146.

72. Minutes, hearings of the JCAE, "Reactions to Soviet Atomic Developments," 28 September 1949, p. 25, Joint Com 5312:5. See also Hewlett and Duncan, Atomic Shield, pp. 353-354.

CHAPTER FOUR

From Company Town to All-America City: Richland Disposal and Incorporation, 1950-1963

In March of 1961 the city of Richland was named one of eleven "All-America Cities" in an annual competition sponsored by Look magazine and the National Municipal League. Residents took great pride in winning such recognition less than three years after incorporating into a self-governing town. The title of All-America City not only confirmed Richland's status as a model community but also rewarded the town for its initiative in rejecting "the easy paternalism of government operation." Indeed, in awarding the prize, Look praised Richland as "a city that faced a problem of growing up and standing on its own two feet."[1] In other words, Richland received the honor because of its independence.

Word of Richland's award doubtless pleased AEC officials, who must have been gratified by the public notice of the maturation of the atomic town. But perhaps the news also brought wry smiles to federal officials, too. In some ways Richland's prize-winning independence had been more imposed on a reluctant community by prodding from the AEC than achieved by the initiative of townspeople. When the AEC first pondered withdrawal from the affairs of atomic cities in 1948, it had taken a "dismal view" of the prospects for "citizen control" in Richland "because of the demonstrated lack of citizen interest."[2] More than ten years would elapse before Richland actually

achieved self-government, a decade punctuated by numerous expressions--including popular votes--against the idea of municipal incorporation.

Furthermore, Richland declared its independence in 1958 only because the AEC had agreed to subsidize town government and local schools throughout the 1960s. The annual payments from the AEC were required because, while Richland had attained local political autonomy in 1958, it remained in many regards a dependent economic colony of the AEC through the next decade and a half. In fact, when the AEC closed down eight of its production reactors at Hanford between 1964 and 1971, the All-America City had little recourse but to turn again to the AEC for assistance in a program of economic diversification. So Richland did ultimately stand up "on its own two feet," but only after it had been pulled upright by the hand of the AEC before 1958, and only because the hand of the AEC continued to steady the town after 1958.

* * *

Richland's incorporation in 1958 was its second. The village had incorporated officially for the first time in 1910. The Army then took it over in 1943 and suspended the operation of local government, but the U.S. government did not actually get around to dissolving the incorporated town until 1948--the very year that the AEC began to think seriously about getting the people of Richland to incorporate once again as a municipality.[3]

The commission's desire to turn its towns over to their residents stemmed from several factors.[4] First, in December 1947

it had adopted the goal of making its communities as "normal" as possible, and normalcy implied not a federally run company town but self-government by residents. Consequently, the AEC made the attainment of "democratic control of a visible local govenment" a "long-run objective."[5] Second, it wished to relieve itself of "the burden of managing" Richland, Oak Ridge, and Los Alamos. The business of operating and governing towns was costly, in terms of money and time. The AEC saw the necessity for staying in the business during the late 1940s and the early 1950s because it regarded the successful and smooth functioning of existing towns as crucial to fulfilling its mission. Yet it simultaneously aspired to free itself from the many problems that town management entailed, and when creating new facilities it expressly avoided building any new government communities.[6]

Third, by managing towns the AEC increased its vulnerability to political and public attacks. Observers criticized the commission's policies for towns as dictatorial, socialistic, profligate, or, in a variety of ways, generally "abnormal." And as the criticisms mounted, so did potentially disruptive proposals to "solve" the problem. Senator Joseph C. O'Mahoney (D, WY), for example, suggested in 1950 that the responsibility for governing the atomic towns should be turned over to residents by the end of the 1951 fiscal year. As much as the AEC wished for relief from the burden of communities, it could not afford to rush into any hasty procedure that jeopardized such work as the output of plutonium at Hanford.[7] Yet in order to disarm critics,

it needed its own plan for moving deliberately and steadily toward self-government in Oak Ridge, Los Alamos, and Richland.

The AEC program for attaining self-government in its communities was formulated in bits and pieces between 1948 and 1951.[8] The commission first hired Lyman S. Moore, city manager of Portland, Maine, to study its predicament, and then adopted most of his recommendations in 1948. Among other things, Moore urged that the AEC separate the operation of the community from the operation of the plant at its different sites. Furthermore, within the realm of community affairs, he urged the commission to "divorce the landlord operation from the responsibility of local government," so that town-management issues would remain distinct from real-estate problems.[9]

After consulting with Moore, the AEC commissioned studies of the feasibility of incorporation (i.e. transforming the towns into self-governing municipalities) and disposal (i.e. selling federally owned real estate to commercial and residential tenants) at Oak Ridge and Richland. (At Los Alamos, the laboratories and town were so intermixed, and the site so isolated and small, that a different and slower process was required by the AEC to divest itself of the community.[10])

To examine Richland, the commission hired Public Administration Service, Inc., a non-profit firm from Chicago. PAS reported in October 1950 that the AEC could achieve its goals in Richland, but in order to do so would have to overcome considerable resistance by residents. It suggested that the townspeople needed to be educated about the desirability of

change, and contended as well that as part of their "education" they needed to begin paying more of their own way. Richland had especially low rents and a rather high amount of services and utilities for a town of its size. PAS conceded that the low rents and lavish amenities may once have been critical for attracting newcomers to Richland, but argued that it was now time to make the citizens bear more of the true expense of living in the town. Only then, the consultants stated, would the demand for private homes increase.[11]

The AEC accepted PAS's recommendations, pleased, among other things, by the idea that raising rents would placate its Congressional critics. Before rents could be elevated to levels comparable to those in surrounding communities, however, federal rent controls were imposed during the Korean War, delaying further increases. On July 31, 1953, Richland and North Richland were removed from the nation's list of "critical defense housing areas," thereby allowing the AEC to proceed with a rent increase for October 1, 1953 of about twenty-five percent. A number of people complained about the sharp rise, but the AEC held its ground because of a federal requirement that it set rents at levels prevailing in surrounding communities.[12] The heightened costs of living in Richland and North Richland were seen as a tool for encouraging tenants to accept disposal eventually.

With its policy toward towns outlined, its feasibility studies completed, and its rents on the rise, the AEC convened a Panel on Community Operations to lay out the procedures it should follow in moving forward with its plans. This panel's

suggestions, made during August 1951 in what became known as the Scurry Report, reiterated the overall goals of the commission and suggested steps toward accomplishing them. Its findings assumed that "the AEC necessities are identical with the necessities of the people" in the towns. Both the commission and the residents of Richland and Oak Ridge wanted "good communities," that is, pleasant, amenity-filled towns that attracted employees, encouraged them to put down roots, and boosted morale, according to the Scurry Report. Both wanted the towns to have their own governments and their residents to become homeowners by purchasing real estate from the government. Both hoped to eliminate the "paternalistic federal control" that perpetuated a "'company-town' situation." In other words, the Scurry Report held that the AEC and its tenants wanted the same things. Only "the less articulate residents" might diverge from this consensus, but even they would come around, provided that the AEC started the ball rolling.[13]

Although the Scurry Report doubted that the AEC would have to change the minds of many of its tenants, it recognized that removing itself from the business of managing and renting towns would be an arduous and lengthy process. Among other things the AEC needed enabling legislation passed by both Congress and the respective state legislatures. Then, it planned a program to dispose of local real estate, making the townspeople homeowners before they became self-governing citizens. Then, it needed to induce Oak Ridge and Richland to vote to incorporate themselves as municipalities with free-standing governments. Following this

political "independence," finally, the Scurry Report explained, the AEC would need to subsidize the operation of schools and local governments for up to 10 or 15 years, or until such time as the cities were generating enough revenue on their own to support the high level of services that the townspeople expected.[14]

The Scurry Report thus laid out a program that would take about 20 years to accomplish. And over that period, so long as plutonium production remained an AEC priority at Hanford, the program could not be permitted to disrupt production. A GE spokesman explained his company's view of the AEC plan:

> The problems involved are complex and difficult and the objective must be attained without adverse affect [sic] on the ability of the company as a principal contractor to attain the prime objective of producing plutonium in ever increasing quantities and at a lower and lower cost.[15]

Even after it let go of its towns, the AEC would retain an interest in their well being, because the towns' success was critical to the success of the AEC plants.

The Scurry Report made it seem as if both the AEC and the people of Richland wanted the same thing--disposal and incorporation of the town with all deliberate speed. In fact, however, there was no certain consensus on the subject at all, on either side of the fence. Doubts prevailed within the AEC itself. The commission's representatives at Hanford hoped to get the "town off our hands" in order to reduce the amount of subsidies they paid as well as the number of headaches they had

to face. They were the ones who had to respond to every single complaint lodged by Richland residents and businesspeople. Officials back in Washington, D.C., on the other hand, despite official AEC policies toward towns, were less eager to let go of Richland. When asked by townspeople whether their opposition to a specific proposal would affect disposal plans, J.E. Travis of the AEC replied in the negative, and added, "The pressure for disposal is from the outside." Travis apparently referred to Congress, and the JCAE in particular, which promised to become increasingly insistent "that the Atomic Energy Commission get out of the business of owning houses and running cities."[16] The AEC was not eager to build new atomic towns, but it apparently remained unsure about how to dispose of the old ones without compromising its larger mission. It did not push for rapid change in the status quo. Neither did officials at GE, who also feared disruptions in plant operations and at the same time did not feel the kinds of political pressure that the AEC felt.[17]

Among the residents of Richland, too, one could find different reactions to the notions of disposal and incorporation. Many citizens responded positively. One man spoke for many when he wrote to Senator Henry M. Jackson about his thoughts. "I like my job here--I like the climate and the people. I like the idea that what I am doing represents a contribution to the welfare of our country." For these reasons he wanted to stay put, and hoped that a program of disposal would enable him to purchase his home.[18]

On the other hand, as one student observed, "considerable resistance to the idea of incorporation" existed during the early and mid-1950s.[19] Opposition stemmed in large part from the sense that Richland would never seem like a conventional hometown, as one woman explained to Senator Jackson:

> This is definitely not a normal community and never will be....The truth is that people are here for one reason only, the job, and not because this is a place for "gracious living." After living here eight years, I have never felt that this is anything but temporary and look forward to the time we can move to a normal community.[20]

This kind of resistance to disposal was perhaps not the sentiment of the majority, but it contributed to a sense of opposition that did not diminish readily. The reluctance of people to buy homes and become self-governing resulted largely from perceptions of the risks of owning homes in a town with such a questionable economic future. The houses seemed plain enough to begin with, many of them erected in a hurry with inexpensive materials during World War Two. Furthermore, many residents of Richland felt reluctant to invest in these homes because they feared that real estate values could decline precipitously. Richland's remained a one-industry economy, and to many people the future of that one industry seemed too uncertain. Hanford could become technologically obsolescent, it was pointed out, or peace could break out, thereby curtailing production and employment. Or, some believed, the government itself could

undermine the local economy by behaving capriciously: "home ownership in a one-industry town subject to the vagaries of congressional action is a luxury only the incompetent can afford."[21] Aware of the boom-and-bust history of Hanford, the townspeople imagined many ways that their economy might collapse and destroy local property values. (One of the things not taken into account when appraising home values was the nature of the work residents did. Asked whether "manufacture of highly dangerous material in the area" might reduce the value of housing in Richland, an official from the Spokane office of the Federal Housing Administration replied, "Value is in the mind. Danger would reduce value only if the people feared it. Here they are used to it."[22])

Opposition to disposal and incorporation, then, stemmed not from principle but from practical concerns. Over the long run, few could oppose disposal and incorporation on moral grounds, because a government-owned and -operated town contradicted the American way. Those who opposed disposal and incorporation were identified as people who wanted "something for nothing" and who supported "a socialistic idea."[23] Most people appeared to accept disposal and incorporation as inevitable. After having the government take care of them, they were doubtless in no rush to embrace the reality of self-sufficiency, which was certain to raise their taxes and housing costs. But few believed they could avoid independence.[24]

The townspeople regarded local home ownership as a risky proposition, but a 1952 poll showed that most expected to buy

their homes, if they were forced to make a choice.[25] What they objected to was the idea of paying prices for their homes that were, in their minds, excessive. The townspeople could be persuaded to support disposal--as well as the notion of self-government--more warmly if the AEC reduced the risks enough, primarily by offering relatively low prices on homes. As time passed, and as Congressional hearings and town meetings on the subject occurred in Richland, however, residents' attitudes toward AEC initiatives in the matter of disposal seemed to become more resistant, for people objected increasingly to the prices they expected to be asked to pay for their homes. In 1952 most people surveyed had conceded that they would buy their homes if they were forced to make a choice, but objected to the tentative costs as determined by preliminary appraisals. Three years later, a citywide ballot tallied a less cooperative response. On the question of whether people favored a property disposal program, 3315 people voted no and 1213 people voted yes. (Citizens registered somewhat less resistance to the idea of local self-government, but still opposed it by a vote of 2414 to 1941.)[26] A primary reason given for the negative reaction was that people felt that estimates of the eventual sales prices of homes remained too high.

Throughout the years of debate over the merits of disposal and incorporation, the Richland City Council served to keep attention focused on the issue while professing to speak on behalf of residents. Councilmembers aired concerns and complaints about AEC proposals, conducted informational town

meetings on the subjects, and sponsored the vote in 1955 that resulted in a three-to-one repudiation of the idea of disposal. Although the council encountered substantial opposition to its efforts, especially in the mid-1950s, it pressed on with the matter nonetheless. Compared to the rest of the community, the councilmembers had become gradually more supportive of the AEC's plans for disposal and incorporation, not because they saw them as flawless but rather because they saw them as inevitable and necessary. In their work these elected officials discovered repeatedly that Richland's dependent status ultimately proved too limiting, and prevented them from meeting many of the needs of the community. As an advisory body only, the council often felt powerless as its resolutions and recommendations were ignored or overturned by GE and the AEC.[27] They consequently supported disposal and incorporation in order to remove many of the uncertainties which, in their minds, clouded the town's future, prevented effective local government, and diminished their own power and respect.

In the aftermath of the negative ballot on the subject of disposal and incorporation in 1955, townspeople came to town meetings to ask the councilmembers to stop encouraging the AEC programs. Still supportive of disposal and incorporation, the council did not change its mind. It recognized that Congress was going ahead with its plans to turn Oak Ridge and Richland loose in any case, and saw no reason to oppose the inevitable or to back away from a process in which Richland citizens needed to have their say if they were to get the best possible terms. In

fact, in May of 1955 the council passed a resolution urging Congress to decide the fate of the disposal legislation quickly. It claimed that "two or three hundred desirable families are moving out of Richland every year to buy homes," and that legislation authorizing disposal and incorporation was needed to eliminate a key source of "instability in the community." The rector of Richland's Episcopal Church agreed, in a 1955 letter to Senator Henry M. Jackson:

> In 1954 some three hundred families left Richland and either bought or built, the majority of them in Kennewick. Needless to say, this state of affairs continues and will continue until such time as land is made available in Richland for the purpose of home construction to the owner's own design. This is removing from Richland the solid dependable type of citizen, and the man who is about to retire....[28]

In the summer of 1955, Congress finally passed Public Law 221, the Atomic Energy Commission Act of 1955, providing for the transfer of property and government of Oak Ridge and Richland from the United States to the townspeople. This legislation, which was passed only after residents of the two atomic cities participated in hearings on the bill, provided a framework in which the process of disposal and incorporation could go forward. Richland residents continued to search for the best possible deal in taking over their town, however, a fact that resulted in even more high tension over the issue of disposal. The AEC asked the Federal Housing Administration to conduct appraisals of housing

in Richland, for the purpose of establishing sales prices, and the process began in the autumn of 1955. When the FHA released its appraisals on May 10, 1956, the residents objected, in an immediate storm of protest, that the proposed prices were again too high. As many as 2,000 people rallied at the Bomber Bowl stadium to organize protests to the AEC and FHA, and townspeople began inundating Congress with letters and petitions.[29]

Responding promptly to the rumblings in Richland, the JCAE immediately dispatched George Norris, Jr., its executive counsel, to the scene. Norris met with townspeople, examined the appraisals, considered Hanford's future, and sent a very critical report back to Washington. He found--as the 1952 census had determined--that most residents of the town were "anxious to buy and own their homes but did not want to do so at these prices."[30] A subcommittee of the JCAE also scheduled hearings on the matter, and in mid-June of 1956 a delegation of Richland citizens traveled to the nation's capital to present their views.

The townspeople explained their desire for lower appraisal values by referring once more to the risk of buying homes in Richland. They argued that the local economy, and hence the value of the housing stock, depended too much on one industry, whose continued output in turn depended too much on political rather than market considerations. Richland residents contrasted their economic situation to that of Oak Ridge, which now had been designated a National Laboratory and therefore seemed to have a more secure future. (Perhaps this helps to explain why residents of Oak Ridge did not protest the appraisals of their homes.) The

Richland delegation argued further that, because of the large number of mediocre homes, most residents were not likely to obtain very good housing. Indeed, the whole range of options in town seemed too limited to offer much choice. Lower prices, it was argued, would enable buyers to spend more money immediately on the remodeling necessary to make the housing stock more satisfactory.[31] Finally, the Richland delegation saw a reduction in housing appraisals as a matter of national security. It seemed that some members of the skilled workforce had already begun to leave the project, and that many more would follow if they did not think they could get fair treatment in housing matters. Morale would collapse, they warned, Hanford would lose its ability to recruit and retain workers, and rates of production would diminish.[32]

Transcripts of the testimony before the JCAE subcommittee are important for revealing both who did and who did not participate and have influence before Congress. In this instance, as well as during previous hearings on disposal and incorporation, organized labor at Hanford was <u>not</u> well represented. Oak Ridge sent three or four union representatives to testify about housing conditions, while Richland sent only one, the HAMTC attorney. The town's delegation consisted primarily of businesspeople, city councilmembers, and technical employees of GE, but not blue-collar men and women.[33] Organized labor did not take--or was denied--an important role in the politics of Richland.

Also excluded from virtually all discussion of disposal and incorporation were the former owners of the lands upon which Richland now sat. These individuals, dispossessed by the Army during World War Two, petitioned to be given first chance at reacquiring their former properties, and offered to pay full price. They complained in particular that, when the government had condemned their holdings in 1943, they were told "that the land would be returned following the war and original owners would be entitled to repurchase." The AEC, however, denied the request.[34] From the commission's point of view, Richland remained a part of the Hanford production effort, and would continue to be needed as the bedroom of the plant even after the completion of disposal.

Although former landowners had virtually no voice and organized labor only a relatively small voice, the General Electric company weighed in quite effectively, above all on the side of the townspeople. From the start of discussion about disposal and incorporation, it had worried about threats to the productivity of the plant, but it resigned itself to the inevitable demise of federal control at Richland and worked to ensure a minimum of disruption in the transfer. At the 1956 hearings, Wilfred E. Johnson, GE's general manager at Hanford, warned of "recurring unrest in the work force" if the government did not reduce the appraisals. Later that summer GE declared further that "plant morale has been adversely affected" by the announced property values.[35] In the late 1940s and early 1950s the residents of Richland had not always liked or trusted town

management by GE, but now they found the company to be somewhat more in their corner.

By far the most powerful advocates for the townspeople were the State of Washington's Congressmen and Senators. Senator Warren Magnuson and Representatives Hal Holmes and Don Magnuson addressed the JCAE in support of Richland residents, declaring that their offices had been inundated by letters protesting the appraisals. Apparently on the basis of this correspondence, Senator Magnuson averred that the FHA estimates were "not equitable" and promised he would not permit Richland "to be gouged."[36] The most forceful of all the state's elected officials in the matter, however, was Senator Henry Jackson, a member of the Joint Committee. Jackson seized this opportunity to become Hanford's most vocal champion in Congress. His questioning of FHA officials regarding the Richland appraisals was rather harsh--perhaps even unreasonably severe--but from the townspeople's viewpoint it was justified and effective. They credited Jackson with much of their success in getting the government to reconsider the original appraisals.[37] (On the same day that he was blasting the FHA, Jackson also introduced legislation to authorize construction of a new dual-purpose reactor at Hanford--the origins of what became the N Reactor.)

The congressional hearings produced the desired result. The AEC contracted with another appraiser, Charles B. Shattuck, and in January of 1957 he recommended a reduction in the sales price on almost half of the homes in Richland--primarily the run-down prefabs and the numerous duplexes which would attract fewer

buyers. The town residents and GE officials acquiesced in these new appraisals, and by June the first house had been sold to private owners.[38] Disposal of both residential and commercial properties continued through the remainder of the decade.

Once arrangements had been made for the sale of real estate, preparations for municipal incorporation moved along comparatively swiftly. By July of 1958, when about 4200 homes had been sold, the townspeople of Richland voted once more on the issue of self-government. Assured of ample financial support from the AEC for municipal operations and schools, they approved incorporation by a five-to-one margin.[39] They also elected a slate of fifteen freeholders to draft a city charter, which would receive voter approval in November. The city stood ready to incorporate before the end of the year. Richland became the first AEC community to achieve political independence. Property sales had begun a year earlier in Oak Ridge (where there had been no dispute over prices), but the eastern atomic town hesitated to incorporate, largely because it feared that the quality of its schools might decline with incorporation. The state of Tennessee could not provide much financial support for Oak Ridge schools, so the town held out more more AEC subsidy.[40] Both towns, in fact, ultimately received federal subsidy to support schools and municipal services until the local economies developed to the point of being able to generate the necessary tax revenues. Richland received an average of about $332,200 for city operations every year between 1960 and 1970 (see Table Four).

Table Four

AEC Assistance Payments to City of Richland, 1960-1970[41]

1960:	$464,111	1965:	$278,123
1961:	287,858	1966:	267,047
1962:	346,639	1967:	335,123
1963:	297,123	1968:	223,767
1964:	348,892	1969:	219,486
	1970:	$586,000	

Independence officially arrived in Richland on December 12, 1958, and the town celebrated with an evening of fireworks. It set off aerial bombs at 8:00 and 8:15, and then at 8:20 began a countdown for a "simulated H-bomb explosion" at 8:30. E.J. Bloch, the Director of Production for the AEC, detonated the device, which consisted mainly of dynamite, with napalm added in order to create a fireball-and-mushroom-cloud effect. The bomb broke two windows in the uptown shopping district. Then, at 8:40, Miss Richland used a "uranium-tipped wand" to light a bonfire, the evening's final pyrotechnic event. Dignitaries from near and far either attended or sent birthday greetings. Henry Jackson, for example, wrote, "Congratulations to Richland, the salutatorian of the atomic age."[42]

Having started off with a bang, the new city of Richland thrived for the next five years. Now that the citizens owned their homes, they set about improving them. By 1963 they had spent roughly $17 million remodeling and enlarging housing that had sold for $28 million between 1956 and 1958. Other forms of growth also characterized these years. By mid-1965 Richland had expanded by 3,110 people to exceed 25,000 in population (an increase of 13.6% since December 1958), added 816 housing units

(11.7%), annexed 7 square miles (79.7%), and acquired 28.1 miles of new roads (31.4%).[43]

Independence, improvement, and growth all led the people of Richland to express general contentment with the community. One year after incorporation, a sampling of residents indicated general satisfaction with the town's direction. And in 1961 the occasion of being named an All-America City offered residents a chance to recite the reasons for their contentment. "Richland has no industry or annoying residents," The Tri-City Herald editorialized. Added Mayor Joyce Kelly, "Richland is debt free. It has intelligent citizens, a low crime rate, good fire protection and the area has abundant electric power."[44] Other commonly listed assets included its comparatively youthful population, its good and well-funded schools, its numerous churches, and the absence of parking meters. Less commonly noted was the community's desegregation. Richland had few non-whites, but because of the authority of federal open housing legislation, its minority residents generally lived next door to whites.[45]

These traits underscored the still common perception that Richland was a model community, and the All-America City title cemented the notion. When Glenn T. Seaborg, chairman of the AEC, visited in 1968, on the town's tenth anniversary and Hanford's twenty-fifth, he identified Richland as "a city of the future" because it exemplified "the kind of thinking and long-range planning that is going to be essential in our country in the coming years, when rapid economic and social change must take

place to meet new national goals."[46] Richland remained on the frontiers of tomorrow and technology.

The community's sense of purpose was reinforced during the later 1950s and the 1960s as Hanford acquired the N Reactor. Unlike the previous eight piles, this new asset was a dual-purpose reactor. Its mission included both production of plutonium and generation of electrical power for the Pacific Northwest. Acquiring the N Reactor meant that Richland's residents now worked not only to defend the United States but also to put the atom to peaceful uses. Finally the community felt it could take part in developing the apparently vast civilian potential of atomic energy.

Although spokespersons within the nuclear industry had been advocating a dual-purpose reactor for years,[47] getting authorization to start building the new reactor at Hanford proved to be no simple task. Senator Henry Jackson introduced legislation (S.B. 4095) in support of the idea on June 21, 1956, and the proposal passed the Senate. But it ran into stiff opposition in the House of Representatives and was defeated there. The idea of a dual-purpose reactor built with federal funds clashed with the interests of private power companies and the coal industry. It also contradicted the Republicans' and President Eisenhower's policies regarding new atomic power plants. Furthermore, even the AEC opposed the idea.[48]

Over the next two years, the proposal for a dual-purpose reactor was modified to make it more politically acceptable. Jackson and others built a stronger case that the government

needed more plutonium, and that the dual-purpose reactor would be an economical method of adding to the supply because the sale of its steam power would help offset the costs of producing the fissionable material. Advocates of a new Hanford pile also deleted from their proposals the power-generating portion of the design. The reactor would be "convertible" to a dual-purpose design, but Congress did not actually commit federal funds for building the power plant at this stage. With these changes, with more encouraging engineering reports on the feasibility of the project, and with a greater desire to appease the JCAE and encourage atomic power plants, the AEC changed its position and supported Jackson's bill. Congress authorized construction of the dual-purpose reactor in 1957, appropriated funds in 1958, and began construction the following year.[49]

Once construction of the new production reactor had been authorized, Senator Jackson and legislators from the Pacific Northwest continued to press for the addition of power-generating facilities. When Senator Jackson had introduced a bill in June 1956--quickly killed in the Senate--to provide $65 million to equip the N reactor with electric generators, the move bespoke the drive toward some kind of diversification for the Hanford complex and its workers. It was an attempt to link Hanford's production mission to the long-delayed hopes for commercial nuclear power, which had been purused steadily by GE at its Knolls Laboratory in Schenectady, New York. It also linked Hanford to the history of the Columbia Basin--a history which included the Depression-era dam projects which had drawn Colonel

Matthias to the spot to begin with, the power and reclamation projects which continued on the Columbia after World War Two, and the controversy of public vs. private power.

When President Roosevelt dedicated Bonneville Dam, he told the crowds gathered for the event that the edifice represented "more power to you," democratic power held in trust by the federal government and not by grasping financial combines. Washington state, in particular, was proud of its public power tradition. In the first month of the AEC's existence, Hugh B. Mitchell, a former U.S. Senator and Seattle financier, wrote to warn David Lilienthal (himself the first director of the New Deal's Tennessee Valley Authority) to keep eastern corporations out of nuclear power.[50] Public-power utilities in the West had been early proponents of government-sponsored nuclear power projects, in the tradition of earlier hydro projects.[51]

Resistance to funding for dual-purpose capability at Hanford also had deep roots, at least in the minds of Northwesterners. Now that Washington's atomic center at Hanford might go into the power business, the old opponents--veterans of New-Deal struggles over hydroelectricity-generating dams--appeared as predicted: private-utility interests and legislators representing eastern coal-producing states. Newspaper editorials in Washington and Oregon were quick to identify this as a struggle over the Northwest's rightful destiny, a destiny which should have rested on abundant electrical power without the attacks of jealous Easterners.[52]

This debate was not settled until after the 1960 election and the change of administrations. The Kennedy administration put through funding for a generating capacity for the N reactor, but only after significant modifications to the original proposal for power-generating facilities in 1962. First, local public utilities--organized as the Washington Public Power Supply System, or WPPSS--and not the federal government, would build and pay for the generating facilities, on land leased from the AEC. (The N Reactor represented the first venture by WPPSS, a consortium created to secure generating capacity for the state's public utility districts, from hydro power into the realm of nuclear power.) Second, the utilities would pay the AEC for the steam from the N Reactor. And third, the utilities would offer to sell half of the power output from the dual-purpose reactor to private power companies (which would assume none of the financial risks of building and operating the power-generating plant). With these conditions added to the legislation, Congress finally approved the dual-purpose operation of the N Reactor. Construction of the power-generating facilities began in 1963, and the WPPSS steam plant was completed in April 1966.[53]

The design of the N reactor differed from the other eight Hanford piles in at least one key respect. Its pressurized, closed-loop cooling system not only reduced the risk of environmental contamination but also made it usable as a power-generating reactor. Unlike in the wartime-model reactors and the Jumbos, cooling water in N was recirculated in a closed system, rather than passing through once on a brief trip from and to the

Columbia River. A heat exchange system could take the reactor's surplus heat and use it to make steam in a separate loop, which would then used to drive electricity-generating turbines. Thus the generating system was kept free from radioactivity, as was the plant's warmed water output at the end of the process. Magnuson and Jackson argued on the floor of the Senate that it was only common sense to make use of this surplus heat, which otherwise would be vented into the air to no good purpose.[54]

Meanwhile, the older production reactors remained very much going concerns, with their power being incrementally increased on a steady basis. The wartime reactors, B, D, and F, had been designed nominally for operation at 250 megawatts; they were certified for operation at 1900 megawatts in January 1959, along with their successors DR and H, while C reactor was run up to 2100 megawatts, and KE and KW to 4000 megawatts. While much of this power would be lost in the course of converting it from heat to electricity, still Hanford's reactors represented a sizeable reservoir of energy. These higher powers were made possible by improved cooling and safety systems: the former allowed for more heat production (which also helped to control graphite creep) and the latter convinced the AEC's safety establishment, which scaled risk up with power level, to allow the higher operating levels.

As the expansion of the eight older reactors suggests, Hanford's main mission remained production of plutonium. But it had now entered the electricity business as well, which meant that the future of Richland and the Tri-Cities no longer seemed so singly tied to the production of weapons-grade plutonium.

More than 30,000 people found reason to celebrate the new departure on September 26, 1963, when President John F. Kennedy visited Hanford to dedicate the N Reactor and help launch construction of the steam-generating facility. In a ceremony reminiscent of Richland's independence day nearly five years earlier, Kennedy waved another "uranium-tipped wand over a Geiger counter to activate a huge clamshell bucket which performed the actual groundbreaking."[55]

In a rather muddled speech, the President linked the atomic frontier at Hanford--especially as embodied in the N Reactor--with his own sense of New Frontiers for the nation. First, he said, it was fitting for the N Reactor "to strike a blow for peace" (i.e. a peaceful purpose for the atom) in a place "where so much has been done to build the military strength of the United States." Second, in Kennedy's eyes the dual-purpose reactor represented the capacity of science and technology to help the nation conserve its resources. By "conserve," Kennedy meant "use our...resources to the fullest." Low-cost atomic power would help Americans meet their ever-growing demand for electricity. Kennedy predicted that Americans needed to double the supply of electrical power every ten years, and that atomic energy plants such as the N Reactor would help fulfill this need. Third, as a new source of electrical power, Hanford and the N Reactor would help Americans maintain and expand their affluence: "this country will be richer and our children will enjoy a higher standard of living."[56]

The President's speech was an important harbinger of things to come. Within a decade, the residents of Richland and the Tri-Cities would be making quite similar arguments. Trying to increase quickly the number of power reactors at Hanford, they, too, would mention the need to double the output of electricity every ten years in order to safeguard the American way of life. But in the early 1960s, few felt any urgency about a second career in generating electricity. Hanford's nine reactors produced plutonium and, as arguments on behalf of the N Reactor had indicated, the demand for that fissionable material remained strong. The AEC may have disposed of Richland's real estate and nudged the townspeople toward incorporation, but there was little hint that the commission intended to curtail plutonium production at Hanford. And so long as the full-scale production of plutonium continued, there appeared to be no reason to expect substantial change in nearby communities.

NOTES TO CHAPTER FOUR

1. TCH March 15, 1961. See also "All America Cities," Look 25 (April 11, 1961): 95.

2. AEC, "Management of Atomic Energy Commission Towns," April 29, 1948, AEC 87, 47-51Sec, p. 5.

3. Information sheet, RPL-CF-Richland-Incorporation.

4. A good overview of the reasoning can be found in Public Administration Services [hereafter PAS], A Report on the Feasibility of Municipal Incorporation and Real Estate Disposition in Richland, Washington, prepared for the U.S. Atomic Energy Commission (Chicago, 1950), 2-4.

5. AEC, "Management of Atomic Energy Commission Towns," 3.

6. AEC, "Draft Terms of Reference for Guidance of a Panel on AEC Community Operations," May 16, 1950, AEC 87/5, 47-51Sec, 1.

7. Gordon Dean to O'Mahoney, June 6, 1950, in AEC 198/25, 47-51Sec.

8. R. G. Scurry, Frederick M. Babcock, George E. Bean, and George Grove [hereafter cited as Scurry Report], "Report and Recommendations of the Panel on Community Operations on Oak Ridge and Richland, To the U.S. Atomic Energy Commission," Washington, D. C., August 11, 1951, AEC 87/14, 51-58Sec, 10-11; "Town Meeting: 'Buying Your House'," Typescript of public meeting, Richland, Wa., February 12, 1953, FCP, 1-2.

9. AEC, "Management of Atomic Energy Commission Towns"; AEC, ""Management of Atomic Energy Commission Towns--Conference of Managers and Washington Staff on May 24, 1948," Aug. 9, 1948, AEC 87/1, 47-51Sec.

10. Marjorie Bell Chambers, "Technically Sweet Los Alamos: The Development of a Federally Sponsored Scientific Community" (Ph.D. dissertation, University of New Mexico, 1974), 361-62.

11. PAS, Report, 10-11.

12. Walter J. Williams to David F. Shaw, Jan. 2, 1951, in "Rentals of Housing Units, Vol. 2" file, Box 11229, 47-51Sec; AEC, "Disposal of Property at Oak Ridge and Richland," Jan. 19, 1953, AEC No. 87/27, p. 6. The rent increase of late 1953, and citizens' reaction to it, are documented in Thomas E. Murray to Warren G. Magnuson, Aug. 12, 1953 (and related papers), WGMP-3, 97:20.

13. Scurry Report, 1-5, 11-12.

14. Scurry Report, 4, 8, 11, pts. D, E.

15. George R. Prout, comments on sale and incorporation of Richland, in transcript of "Council Talks" radio show, July or August 1952, FCP.

16. Deutschmann, "Federal City," 85; "Town Meeting: 'Can We Pay Our Way?'," Typscript of public meeting, Richland, Wa., February 19, 1953, FCP, 1-2; Fred Clagett cited in TCH, March 15, 1961; Travis cited in "Town Meeting: 'Buying Your House'," 5; JCAE, Proposed Legislation to Effect Disposal of Government-Owned Communities at Oak Ridge, Tenn., and Richland, Wash., and Other Pertinent Documents (Wash., D. C.: GPO, 1954), 1; JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a subcommittee on Disposal of Government-Owned Communities of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Fourth Congress, First Session, on Disposal of Govenment-Owned Community at Richland, Wash., June 18 and 19, 1954 (Washington, D.C., 1955), 52.

17. Deutschmann, "Federal City," 85, 253.

18. A.J. Clements to Henry M. Jackson, May 10, 1955, HMJP-3, 112:27.

19. Deutschmann, "Federal City," 44.

20. Mrs. H.O. Forde to Henry M. Jackson, May 11, 1955, HMJP-3, 112:27.

21. "Town Meeting: 'Buying Your House'," 1, 5; USC-JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a subcommittee, 20; "Town Meeting: 'City Government'," Typescript of public meeting, Richland, WA, February 26, 1953, FCP. Lists of reasons for and against disposal were presented in Minutes of RCC, May 2, 1955, on file in HMJP-3, 112:26.

22. "Town Meeting: 'Buying Your House'," 3.

23. Minutes of RCC, May 14, 1955; "Town Meeting: 'City Government'," 1953, including summary of questionnaires by 116 people on attitudes toward sale of property [hereafter cited as QS]. The idea of Richland as socialistic, and residents' expectation that they would ultimately buy their homes, are expressed in Richard H. Syring, "Richland Ruction," Wall Street Journal, August 2, 1952.

24. JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a subcommittee, 90; Syring, "Richland Ruction."

25. USBC, "Report of the Survey on Home Ownership and Self Government in Richland, Washington," conducted for AEC, June 30, 1952, WGMP-3, 87:18, pp. 6-7. This common sentiment was repeated in Clements to Jackson, May 10, 1955.

26. Minutes of RCC, Feb. 7, March 10, 1955.

27. See, for example, the council's impotence in protesting an increase in rates for telephone service, Minutes of RCC, April 5, 1954, in WGMP-3, 97:8. Newspaper editorials complained of the "high-handed" and "arbitrary" actions of GE and the AEC, and lamented the inability of the RCC to have any influence on the issue. CBN, March 31, May 1, 1954.

28. Harold O. Monson, Mayor, "Richland City Council Accomplishments and Objectives 1955-1956," Jan. 16, 1956, in Minutes of the RCC, Jan. 9, 1956, FCP, 1-2; Minutes of RCC, March 21, May 14, 1955; William G. Greenfield to Henry M. Jackson, May 11, 1955, HMJP-3, 112:26. Councilmember Pat Merrill echoed the concern that too many residents were leaving the village: Merrill to Henry M. Jackson, July 8, 1955, HMJP-3, 113:1.

29. Minutes of RCC, May 14, 21, 1956.

30. George Norris, Jr., Memo, "Richland Appraisals and Richland Trip," May 31, 1956, HMJP-3, 24:5, esp. p. 7.

31. JCAE, Subcommittee on Communities [hereafter cited as JCAE-SC], "Stenographic Transcript of Hearings Before the Joint Committee on Atomic Energy, Congress of the United States," Washington, D.C. June 11, 19, 20, 21, 1956, transcripts by Alderson & Veley, Washington, D.C., 4 vol. (one for each day of hearings, in FCP), 6, 8, 22-27, 41-42, 48; TCH, June 20, 1956, March 12, 1978.

In his report, Norris also acknowledged the uncertain future of Hanford. He recommended that Hanford, like Oak Ridge and Los Alamos, should become a "National Laboratory" so it could perform more research and development, particularly in the area of power reactors. Norris, "Richland Appraisals and Richland Visit," 9.

32. JCAE-SC, "Stenographic Transcript," June 19, 1956, pp. 32-33, 295-98; Minutes of RCC, Sept. 4, 1956, Jan. 7, 1957.

33. JCAE-SC, "Stenographic Transcript," June 19, 1956, pp. 19-20. See also the absence of HAMTC representatives in 1954 hearings, according to notes of C.C. Ohlke in Memo to files, June 30, 1954, in AEC, "Report of Congressional Hearings at Richland on Community Disposal Bill," July 2, 1054, AEC No. 87/51, 51-58Sec, p. 2; and the lack of union representation at 1955 hearings, according to RCC, "Accomplishments and Objectives 1955-1956, Jan. 16, 1956, attached to Minutes of RCC, Jan. 9, 1956, in WGMP-3, 103.8. The AEC files on Community Management, General

Policy, Vol. 1-6 (esp. vol. 5), 51-58Sec, contain much record of input from members of the United Gas, Coke and Chemical Workers of America, CIO, at Oak Ridge.

34. JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a subcommittee, 80-83; A.S. Murray to Herbert Brownell [letter with petitions enclosed, sent to U.S. Attorney General], Jan. 17, 1955, HMJP-3, 112:26.

35. JCAE, Disposal of Government-Owned Community at Richland, Wash.: Hearings before a subcommittee, 26-33; JCAE-SC, June 19, 1956, pp. 12-18; Minutes of RCC, Aug. 6, 1956. The existence of labor unrest at Hanford in the spring of 1956, before announcement of the FHA appraisals, doubtless made GE especially nervous. See papers relating to disagreement in HMJP-3, 24:1.

36. JCAE-SC, "Stenographic Transcript," June 19, 1956, passim, esp. pp. 5, 7, 60.

37. JCAE-SC, "Stenographic Transcript," June 20 and 21, 1956; Minutes of RCC, July 2, 1956.

38. Charles B. Shattuck, "Appraisal Review Report; Appraisal Atomic Energy Community, Richland, Washington," [Jan. 2, 1957], FCP; K.E. Fields to Albert M. Cole, Jan. 25, 1957, in 51-58Sec, 1243:3; Minutes of RCC, Feb. 21, 1957.

39. "Goodbye to All That," Time 72 (December 22, 1958):18.

40. TCH, Dec. 12, 16, 1958, RPL-CF-Richland-Incorporation.

41. D.G. Williams to John C. Ryan, Sept. 15, 1966, RDF 5:7; A.M. Waggoner to Sherman B. Boivin, Aug. 18, 1969, RDF 9:5.

42. CBN, Dec. 12, 13, 1958; Richland Commencement Day Souvenir Program, 1958.

43. Field, The Tri-City Area Handbook on Economic and Human Resources, 11; Fred Clagett, "Richland Growth Since Incorporation," July 12, 1965, FCP.

44. TCH, Dec. 11, 1959, April 9, 1961.

45. Battelle Memorial Institute, Summary Report on Economic Analysis of the Tri-County Area: Benton, Franklin, and Walla Walla Washington to the Pacific Northwest Laboratories of Battelle Memorial Institute November 10, 1964 (Columbus, OH, 1964), A-2; Field, The Tri-City Area Handbook on Economic and Human Resources, 4-5; "Plutonium Town," Newsweek 63 (April 20, 1964):82; Melvin M Finkbeiner, "The Man in the House Next Door," February 2, 1964, FCP, 4.

46. Glenn T. Seaborg, "Large-Scale Alchemy--25th Anniversary at Hanford-Richland," AEC press release, June 7, 1968, FCP, 6.

47. Additional discussion of the N Reactor is located above in Chapter Three. For early calls for a dual-purpose reactor, see J.R. Menke, "Reactor Designs for Commercial Power," Nucleonics 12 (January 1954): 66, 68; "U.S. Power Reactor Program....Goal: Economic Power in 10 Years," Nucleonics 12 (July 1954): 48-51. Both articles cited Hanford's reactors as models for the economical production of electricity, given that their technological backwardness was outweighed by their well-established construction and operating histories.

48. Rod Fowler, "Dual-Purpose Politics: The Origins of Hanford's N Reactor," 1993 MS in author's possession, pp. 6-9; Richard G. Hewlett and Jack M. Holl, Atoms for Peace and War, 1953-1961: Eisenhower and the Atomic Energy Commission, vol. III, A History of the United States Atomic Energy Commission (Berkeley, 1989), 409-414, 424-29.

49. Fowler, "Dual-Purpose Politics"; Bonnie Baack Pendergrass, "Public Power, Politics, and Technology in the Eisenhower and Kennedy Years: The Hanford Dual-Purpose Reactor Controversy, 1956-1962" (Ph.D. diss., University of Washington, 1974); "Roundup: Pu Dual Reactor Okayed," Nucleonics 16 (Oct. 1958): 32; Irving Gabel and George Zelensky, "Nuclear power plant at Hanford, Nation's largest, ready this year," Electrical World 165 (February 21, 1966):80.

50. Hugh B. Mitchell to David E. Lilienthal, October 29, 1947, LP, Box 7.

51. "Colorado, Coast Groups Want Nuclear Power," Nucleonics 12 (Sept. 1954): 80-82.

52. See collected clippings, HMJP-3, 62:5.

53. Pendergrass, "Public Power, Politics, and Technology," passim, esp. 165; "Briefing Data--Richland, for Chairman Seaborg's March 29, 1967 Visit," March 1967, RDF 4:10.

54. HMJP-3, 62:7, and 233:46.

55. Pendergrass, "Public Power, Politics, and Technology," 175.

56. TCH, Sept. 27, 1963.

CHAPTER FIVE

Years of Diversification:

Hanford and the Tri-Cities 1964-1971

The years 1943-1963 may be regarded as one distinct era at the Hanford site. In those two decades, the plant's mission remained basically the same--production of weapons-grade plutonium. When changes in this period occurred, they resulted mainly from fine-tuning the original mission, not from any overall switch in direction. The most significant change between 1943 and 1963 was growth, as the demand for Hanford's product increased. The site went from having no reactors in 1943 to nine reactors by 1963, all designed to produce plutonium. The newest addition at Hanford, the N Reactor, would ultimately produce electricity as well as fissionable material, but everybody concerned with it during the early 1960s understood that plutonium production took precedence over generating power.

This first era at Hanford started to close in January 1964 when President Lyndon B. Johnson announced, in his State of the Union address, that the AEC would shut down three Hanford reactors within two years. Thus began a transitional period characterized not by growth but by contraction. Between 1964 and 1971, the AEC closed down each of the eight Hanford reactors built between 1943 and 1955 (see Table Five). Only the N Reactor remained in operation at Hanford, and at N the generation of electricity would soon begin to take precedence over plutonium production. The closing of eight reactors brought both an end to

the old, well-defined mission and a search for a new purpose for Hanford and Richland. Until 1964, almost 100% of federal expenditures at Hanford supported weapons work. By 1967, expenditures on military and non-military purposes were about even; by 1975, military purposes accounted for only 25% of federal expenditures at Hanford.[1] (Closure of the eight old production reactors also reduced substantially the amount of radioactive materials released into the Columbia River.[2])

Table Five:
Startup and Shutdown Dates of Hanford Production Reactors[3]

Reactor	Startup	Shutdown
B	Sept. 25, 1944	Feb. 12, 1968
D	Dec. 14, 1944	June 25, 1967
F	Feb. 24, 1945	June 25, 1965
H	Oct. 19, 1949	April 21, 1965
DR	Oct. 3, 1950	Dec. 30, 1964
C	Nov. 18, 1952	April 25, 1969
KW	Jan. 4, 1955	Feb. 1, 1970
KE	April 17, 1955	Jan. 1971
N	1964	1986

While the smaller reactors had continued to be run at well over their designed power--B, D, DR, F, and H had power maxima set at 2,090 megawatts in February of 1964, although DR was poisoned by an accidental release of its boron ball safety system the year before--they were shut down beginning in late 1964. By the time a new contractor (Douglas United Nuclear) took over responsibility for Hanford's production operations in November 1965, H and F had been deactivated. D reactor was shut down in June 1967. These closures were followed by those of the B reactor in February 1968, C in April 1969, KW in February 1970, and KE in January 1971.

The reactor shutdowns stemmed from more than one cause. Hanford's mission was limited not only by policy, which designated it a production center and awarded it mainly old-technology reactors, but also by the laws of physics, which dictated that Hanford's main product, plutonium, had a half-life of nearly 24,000 years. By the early 1960s, the demand for plutonium was considerably reduced because substantial stockpiles were in place. As a result, Hanford was faced with a declining work force and a diminution of its central mission of producing plutonium. Between 1967 and 1971, the number of plutonium-producing employees at Hanford dropped from 8,500 to 5,500, and of the nine production reactors only N remained in operation after January 1971. The main separation facilities, Redox and Purex, also closed during this time, the former in December 1967 and the latter in June 1972.

In response to cutbacks, the Tri-Cities and Washington state pursued a change in Hanford's mission to enlarge the emphasis upon the production of electricity and research, tasks handicapped until then by Hanford's history since the war. Citizens approached the federal government with the expectation that it would play a key role in redefining Hanford's purpose. The AEC's responses to cutbacks at Hanford were technological and political. In an effort to encourage the use of the site's resources and work force in new ways, the Commission increased its commitment to research activities and power production at Hanford, spread responsibility for managing Hanford's activities

among several contractors, and required those contractors to invest in the local economy.

Technologically, three bright spots remained at Hanford: the successful operation of N reactor with its dual military and civilian mission; the authorization of the new Fast Flux Test Facility, designed initially to test fuels for breeder reactors; and the selection of Hanford as one site for two WPPSS reactors. These projects promised continuing work for Hanford's skilled employees, albeit ones which depended on the success of civilian nuclear power in the United States.

While the nuclear community in the Tri-Cities anticipated increased activity in the civilian uses of atomic energy, it remained unsure as to who, exactly, would oversee the movement in these new directions. Days after LBJ's announcement that the first two reactors would close, the AEC announced another dramatic change: the withdrawal of General Electric from Hanford. The main contractor since 1946, GE had been one source of continuity through the growth of the late 1940s and the 1950s. Now that the plant's mission would change somewhat, however, the AEC decided to launch a program of "segmentation" and "diversification" at Hanford. It determined that the presence of one large contractor inhibited the economic development of the region by discouraging other businesses from coming. In the mid-1960s the AEC proposed to divide up (or segment) the plant's work into different areas of operation, and select a number of new contractors, rather than just one, to take on each area of operation. Furthermore, as part of negotiations with each new

contractor, the AEC would insist that the companies taking over work at Hanford committed funds to diversifying the local economy. Nobody knew for sure what the new economy would look like, but in encouraging diversification the AEC tried to cushion the economic blow to the Tri-Cities of the eight reactor closings at Hanford. Thus the communities' search for a new purpose became intertwined with AEC efforts to bolster the local economy in the wake of reactor shutdowns.

In enacting a policy of segmentation and diversification at Hanford and Richland, the AEC made sure to serve its own continuing needs in the vicinity of the Tri-Cities. However, it hardly imposed the program unilaterally upon the citizens of Washington state. Rather, Washington's political and economic leaders, operating at the federal, state, and local levels, consulted with and pressured the AEC continuously, and ensured that segmentation and diversification unfolded with their input. The AEC required local citizens to show initiative in attracting new private firms, so local businessmen formed the Tri-City Nuclear Industrial Council (TCNIC) to spearhead community efforts. The council worked to recruit companies to Richland, Kennewick, and Pasco, and it lobbied the AEC extensively throughout the 1960s in order to get just the kind of assistance that these business leaders desired.[4] Together, TCNIC and the AEC enjoyed some success in diversifying Richland's economy.

Yet, by the early 1970s the metropolitan area remained heavily dependent upon atomic energy as an economic staple. It now looked more to peaceful uses of the atom, rather than simply

to weapons-grade plutonium, but one could argue that its dependence upon the atom remained too strong. In fact, there was a striking parallel between what happened at Hanford and what happened at The Boeing Company in Seattle. Like Hanford, Boeing tried to diversify in the 1950s and 1960s by moving away from dependence upon military spending, and it succeeded in becoming the nation's largest manufacturer of commercial jet aircraft. But while Boeing diversified Seattle did not; the city continued to depend upon Boeing almost as much as the Tri-Cities depended upon Hanford. And when economic downturns within an entire industry occurred (aircraft in Seattle, atomic energy at Hanford), the communities discovered that they had not transformed their economies enough. True diversification would take longer than a decade to achieve.

* * *

When the AEC set about disposing of Richland during the 1950s, it had met considerable resistance from town residents who feared for the future of the Tri-Cities' one-industry economy. The townspeople were not eager to own homes in a place where local prosperity was subject to the capricious fortunes of politics, diplomacy, and technological obsolescence. In the 1960s it became apparent that these concerns of Richland's residents had been justified. The closure of eight of the site's nine reactors exemplified precisely the kind of instability about which they had worried when they considered purchasing their houses. Yet in the 1950s the pressure to dispose of the town had been immense. The AEC was simply compelled to address critics'

complaints that its ownership and operation of atomic cities were too "socialistic" for America. So, in spite of the townspeople's fears, it had sold off Richland's homes and businesses.

In so doing, however, it created a community of homeowners and business people with a much more profound economic stake in the area. Consequently, when the AEC began to shut down reactors during the 1960s, its actions represented a much greater economic threat than would have arisen without disposal. Had Richland's residents remained tenants, without a large financial investment in local property, they might have found it easier to adapt to the eventual AEC cutbacks at Hanford. But as owners of homes and businesses, the people of Richland had a much more urgent reason for demanding that the AEC work to mitigate the impact of its reactor closings. Paradoxically, then, by acting in the 1950s to dispose of Richland, in response to critics of the federal subsidies flowing to atomic towns, the AEC helped to create a propertied class in Richland which, in the 1960s, forcefully pressured the Commission to use direct and indirect subsidies to protect the privatized economy of Richland. The result was an elaborate program of diversification, orchestrated in large part from Washington, D.C., beginning in 1963.

Although the AEC embraced a policy of diversification in the 1960s, concern about the area's one-dimensional economy dated back to at least the late 1940s in Richland, when planners hired by GE had pondered the economic future of the village. On the surface, broadening the economic base seemed like an easier task in Richland than it would be in Oak Ridge and Los Alamos, because

Richland had never been behind a fence. Also, the continued development nearby of the Columbia Basin Project appeared to promise an ideal counterbalance to the local plutonium industry.[5]

Yet seizing new economic opportunities proved almost an impossible task through the 1950s. The Richland Community Council took up the matter of diversification regularly during the decade, and even created an Industrial Committee to survey the issue. Hoping to develop an economic and revenue base apart from the Hanford Works, the committee's inquiries produced discouraging results. The town had no desirable housing to accommodate new workers for much of the decade, and perhaps contained as well too few industrial acres, municipal facilities, and available workers to attract new industry. Even more importantly, it lacked much flexibility to change its circumstances. When W.W. Birchill of the State Industrialization Utilization Committee studied prospects for diversification in 1955, he concluded that Richland could accomplish very little "until Federal restrictions are removed." In light of this news, the council's Industrial Committee disbanded.[6] Given such bleak prospects, it is no wonder that so many residents of the town hesitated to go along with the AEC program of disposal and incorporation, although news of the proposed N Reactor doubtless offered some reassurance.

Once Richland became its own city in 1958, residents continued to keep an eye out for opportunities to broaden the local economic base. For example, recognizing that reactor products other than plutonium might have market value, city

planners applauded when Hanford hired the consulting firm of Arthur D. Little, Inc., "to conduct a year-long comprehensive study of the market for cobalt-60, cesium-137, and other radioactive byproducts."[7] Wishing to attract other types of industry, local leaders tried to explain why the town would make a good choice for new businesses. They used the occasion of the All America City award in 1961 to remind outsiders that Richland was a model community. They also attempted to convince people of the logic of relocating away from the coast by terming the Tri-Cities and Pacific Northwest "the next frontier. California is crowded. The only place to go is up here."[8]

In the eyes of local boosters, the mid-Columbia's wide-open spaces contained room enough for both more residents and more reactors. Ted Van Arsdol, a local newspaperman, argued that the buildup of population and industry along the Pacific Coast, especially in California, was unwise from both an ecological and a military viewpoint. He offered the Tri-Cities, adjacent to Hanford and the Columbia Basin Project, as a logical alternative. Van Arsdol's perception of "the inland region"--that it "has been fighting an often losing battle against the erosion of population and the exploitation of its resources by persons whose primary interests were at other points"--represented a classic statement of the hinterland's complaint against the metropolis, and of the interior West's complaint about the Coast.[9] It also repeated the classic mistake of not appreciating fully why the wide-open spaces of the interior West did not measure up to the urban amenities of the coastal region, at least in this period.

Although some felt that Richland <u>should</u> be an attractive site for industry, there remained a definite awareness of Richland's shortcomings for attracting new businesses. This awareness was expressed at hearings on the subject of diversification, conducted by the AEC in Richland in June 1962. Without AEC assistance payments, speakers testified, the town would have a hard time raising enough revenue to provide an adequate level of services. There was too little private land--especially industrial and commercial real estate--on the tax rolls, and too few businesses for a town of its size as well. Richland seemed to lack a strong commercial core, both financially and spatially, and the prevailing wage rates, set by the plant, struck many as too high to assist in recruiting new industry. In sum, businesses had even more reason than prospective homeowners to be reluctant to invest in the town. And because the obstacles to diversification seemed so formidable, local leaders quite naturally appealed for assistance to the AEC.[10]

The Atomic Energy Commission was holding hearings in Richland at this time because it, too, felt concern about the fate of Richland and Oak Ridge. It had formed a committee to study the problem and suggest an AEC policy on "cooperation in community industrial development efforts," and in November 1962 the committee issued its findings (called the Slaton Report after William H. Slaton, head of the committee). The Slaton Report began by noting that "industrial development of communities is not a statuatory objective of the AEC," but went on to say, "It

is AEC policy to extend reasonable cooperation to the economic development efforts of communities in which AEC activities constitute the major economic force." The AEC wished to provide this assistance in part because it admitted to a "moral obligation to prevent [Richland] from becoming a depressed area." More practically, the AEC also needed to sustain "a reasonably stable and healthy economic environment" around its plants in order to ensure their efficient operation. In the weeks after President Johnson's announcement in early 1964 of reactor shutdowns, William H. Slaton warned further that, without help from the AEC, the cutbacks proposed at Hanford could create in Richland a downward "spiral of delinquency, slums, crime, broken families, poorer health, and greater unemployment."[11]

The Slaton Report found that former AEC towns had both assets and liabilities in pursuing new business opportunities. It suggested that tourism would become a profitable industry in both Richland and Oak Ridge, and got the AEC to consent to "individually prearranged bus tours through its Hanford area under controlled conditions." Hanford also featured "extensive laboratories" and "skilled scientists and engineers" which would theoretically help attract additional high-tech industry. At the same time, the town lacked most of the elements of an intellectual infrastructure, such as a research university, that new high-tech industry might require. The AEC itself thought of a number of initiatives it could take to assist Richland. It offered to make excess land available, such as a 400-acre parcel requested by the Port of Benton. Also, to help publicize

Richland to potential investors by identifying it as the headquarters of the Hanford Works, the AEC changed the name of the Hanford Operations Office to Richland Operations Office.[12]

Although the AEC demonstrated some interest in helping Richland and Oak Ridge, the Slaton Report stated that it would neither take the lead in bringing new business to its former communities, nor interfere in local government. Committed only to offering "reasonable cooperation," the Commission expected the communities themselves to assume the primary initiative. This proposal disappointed those who had hoped for more involvement by the AEC. John T. Conway, executive director of the JCAE, complained to Senator Jackson that "The proposed action by the commission...involves no major area of assistance." And in another letter to Jackson, Glenn C. Lee, publisher of the Tri-City Herald, deemed the Slaton Report "not helpful, not encouraging, and not workable." Lee pointed out that community leaders had virtually none of the technical expertise needed to understand opportunities available in the nuclear field, "no access to AEC files, and no permit to visit and inspect the plant." He believed that, without more prodding, the AEC and GE would not keep community leaders adequately informed about opportunities for economic diversification. Fatefully, Lee appealed especially to Senator Jackson to "champion the cause" of Richland, and Jackson responded by taking up the challenge.[13]

Jackson's advocacy in the nation's capital on behalf of Hanford and the surrounding communities was hardly new in 1962 or 1963. He had been a Hanford booster even in the late 1940s, as a

Congressman representing a western Washington district and a member of the JCAE. Since the mid-1950s, along with Senator Warren G. Magnuson, he had been active in supporting the economic interests of Tri-City constituents by arguing against the high appraisals of Richland homes and by supporting the dual-purpose N Reactor. Over the succeeding two decades, Jackson was joined in the ongoing campaign for Hanford and the Tri-Cities not only by Magnuson but also by Washington's delegation in the U.S. House of Representatives and by the state's governors--Albert Rosellini, Dan Evans, and Dixy Lee Ray. Indeed, the state's highest political leaders maintained a consensus of support for Hanford through the 1970s and into the 1980s. Their enthusiasm for the nuclear industry in fact contrasted markedly with the cool reception given to Hanford by Washington's elected officials during World War Two, when Congressman Holmes had tried to distance himself from the project and Governor Wallgren had encouraged the Army to send all the workers--and especially the African Americans--away at war's end.

Statewide support for Hanford probably reached its zenith during the 1960s, when political leaders united behind the nuclear industry and the Tri-Cities in response to the closing of reactors. The effort to find assistance for Hanford succeeded especially at the federal level, where Jackson, Magnuson, and the Tri-Cities' representatives in the House wrung considerably more support for diversification from the AEC than the Slaton Report had envisioned. To do so, members of Congress had to develop a close alliance with local businessmen.[14] Tri-City boosters,

responding to the AEC requirement that communities take the initiative in diversification efforts, organized themselves in early 1963 into the Tri-City Nuclear Industrial Council in order to promote diversification of the local economy. The council vowed to identify and attract both new private businesses and new government programs to the area, as well as to publicize the resources and amenities of the region. It especially aspired to move Richland into "the civilian atomic field" and into "space and missile work."[15]

Unlike similar groups from other towns, TCNIC grew to have considerable influence.[16] One reason for its success was its connections to the local media. TCNIC's president was Robert F. Philip, also president of the Tri-City Herald; the Herald's publisher, Glenn Lee, served as TCNIC's Secretary-Treasurer. Needless to say, the Council's viewpoint was well respresented in the local press. The newspaper kept "the issue and results of diversification...on page one." Furthermore, as one friendly student of TCNIC explained, "a clear policy of attitude formation was embarked upon by the Tri-City Herald" in order to encourage local residents to support TCNIC's efforts.[17]

TCNIC's success also depended heavily upon good connections in Washington, D.C. The most important connection, of course, was Jackson. The Senator met with the council during its first month in existence, February 1963, and the following month he helped to arrange a meeting in Richland attended by TCNIC, Chairman Glenn Seaborg of the AEC, top officials from the AEC Richland Operations Office and from GE, and Jackson himself. The

Senator returned once more in July to monitor the progress being made toward diversification. And over the ensuing months, Senator Jackson was especially involved in developing a program of diversification that was tailored as much as possible to the community's needs. Suddenly, TCNIC members noticed, they enjoyed much more direct communication with AEC headquarters.[18]

Members of TCNIC soon learned that, in addition to having members of their Congressional delegation visit the Tri-Cities, they themselves needed to establish a regular presence in the nation's capital. One of their very first actions was to hire a Washington, D.C., "atomic-consulting firm" to lobby on behalf of the Tri-Cities. They also eventually understood that they themselves needed to travel eastward on occasion. In May 1964, Sam Volpentest, a Richland banker and TCNIC vice-president, wrote a telling thank-you note to Senator Magnuson:

> Just a line to express my appreciation for the time you gave to Glenn Lee and myself....We now realize the importance of coming to Washington [D.C.] regularly and will be more constantly in touch with you....Warren, we appreciate all that you and "Scoop" [Jackson] are doing for us and will attempt to help you all that we can from this end of the country.[19]

TCNIC's "help" for the two Senators took a number of forms. The Council sent Jackson and Magnuson a steady stream of clippings from the Herald in order to update them on local attitudes and developments. The clippings were also intended to illustrate how the local press had handled a particular story.

Members of TCNIC were especially eager to point out that Herald articles portrayed the Senators in the most favorable light. "I am enclosing another nice editorial pointed in your direction," Volpentest wrote to Magnuson in 1964. "More will be forthcoming I promise you." TCNIC also enlisted in the Senators' re-election campaigns. According to a 1970 article in Science, Volpentest had "raised thousands of dollars for [Senator] Magnuson's and [Senator] Jackson's political campaigns, and this, he feels, has helped assure him of cordial entree to their offices."[20]

The involvement of Senators Jackson and Magnuson in the diversification effort proved to be crucial. The Slaton Report had warily steered away from committing the AEC to any expenditures in its former communities, but throughout the 1960s the Commission either spent its own appropriations on assisting diversification in Richland, or required that its Hanford contractors invest some of their capital in the local economy. There is no doubt that Jackson and Magnuson figured heavily in pushing the AEC to take these additional steps. The two Senators responded faithfully to calls from their Richland constituents for further involvement. They also visited Hanford and Richland regularly, and their comments indicated that they were both well-informed and concerned about Richland. That the Tri-City Herald eventually dubbed Senator Jackson the "father" of Richland diversification suggests as well his importance in getting the AEC to pay close attention to the wishes of local leaders.[21] (It is worth noting that no other AEC site received such intense support from the Commission specifically for its diversification

efforts, although segmentation was also implemented at the National Reactor Testing Station in Idaho.[22])

While it was later suggested that news of the cutbacks at Hanford in early 1964 came as a surprise, it seems in retrospect that Washington's Senators, the AEC, and TCNIC were all organizing throughout 1963 for what they regarded as an inevitable blow.[23] Thus they seemed quite prepared when on January 8, 1964 President Lyndon B. Johnson announced a twenty-five percent reduction in plutonium production, even before the N Reactor began productive service. Glenn T. Seaborg followed up the President's message with a statement that the AEC would shut down four of the nation's fourteen production reactors in order to comply with LBJ's order. Because Hanford's plant included some of the nation's "oldest and smallest reactors," three of its reactors were among the four targeted for shutdown. Seaborg estimated that 2,000 positions, or 24 percent of the Hanford work force, would be lost as the three reactors were phased out in 1964 and 1965.[24]

The threat to Hanford's future stemmed in large part from the fact that the site contained primarily outdated models of reactors. Hanford's place in history was assured because it was home to the world's first production reactors, but those same historic reactors jeopardized its economic future. It was also the case that Hanford, in contrast to Oak Ridge and Los Alamos, had fewer immediate opportunities for diversification because, with its focus so exclusively on production, it did not acquired the status of a National Laboratory. GE had maintained the

Hanford Laboratories, but the site's primary mission had never been research and development.

For these reasons, as well as others, little in the way of diversification had been accomplished prior to 1964. An official with the Department of Defense's Office of Economic Adjustment, who was used to assessing the local impacts of military spending, had in 1963 found the area around Hanford "more completely dependent on Government payrolls than any other with which the Office of Economic Adjustment has had contact with." The same observer also remarked upon "another factor of great importance," "the community's total psychological dependence upon Federal activities."[25] Diversification programs were viewed as a means of ending local economic dependence upon the federal government. That these programs were pursued primarily through Congress, the AEC, and other federal agencies suggests the depths of the area's psychological dependence on Washington, D.C.

Diversification, it was decided, needed to be accompanied by segmentation if it was going to have any chance of success. Thus President Johnson's and Chairman Seaborg's statements of January 8, 1964 were followed on January 21 by an announcement by the AEC and GE that the General Electric Company would withdraw from Hanford. This decision resulted in large part from pressure on the AEC by local leaders and the state's elected officials, especially Jackson. GE presented at least two significant obstacles to the diversification effort. First, although GE was itself interested in commercial nuclear power, it did not perform research or development in that area at Hanford. Instead, it

concentrated much of its effort in nuclear power at its growing facilities in San Jose, as it had earlier at the Knolls Atomic Power Laboratory.[26] Since 1954 there had been a "somewhat steady stream of people transferred from Hanford to other GE installations, particularly in San Jose," according to one employee, and the flow accelerated anew in 1964, depleting the Tri-Cities' talented work force. Glenn Lee had complained about this situation to Jackson as early as November 1962:

> it is a sort of a "captive situation" where if any new ideas are generated here at the plant by the General Electric Company they send their men with these ideas in their brains down to California and develop the ideas there. Our region suffers accordingly.[27]

The community needed contractors who demonstrated more commitment to the mid-Columbia region.

GE's image constituted another problem. In the years just prior to 1963, a few companies from around the country had explored the possibility of locating some of their operations in Richland, but the presence of the single powerful contractor apparently discouraged them from moving there. Frederick H. Warren, an engineer with the Washington, D.C., consulting firm hired by TCNIC, urged in September 1963 that the AEC needed to dispel the "prevailing opinion, even among major industries, that the General Electric Company essentially has all prime opportunities 'sewed up'" at Hanford. Warren continued by suggesting, as Glenn Lee already had in a number of letters to AEC chairman Seaborg, that the Commission consider offering some

of GE's work to other contractors. Unless it did so, he believed, other companies could put no faith in Richland: "Continued insistence by AEC that no 'segmentation' of the operating functions is possible will be construed as thinly disguised preservation of the GE monopoly."[28]

Irrespective of why GE and the AEC ended their partnership, when the prime contractor announced its withdrawal from the project in January it stated that it had made the decision in order to assist in the diversification of the local economy. GE's general manager for its Hanford Atomic Products Operation conceded that his company's presence was inhibiting the recruitment of new businesses to Richland. Instead of dealing with one main contractor, the AEC now proposed to segment the work GE had performed into six separate realms, and to hire a different contractor to preside over each. Having several smaller contractors, rather than a single giant one, reportedly would enhance the idea of relocating businesses to Richland. And, in fact, the amount of interest in local industrial opportunities appeared to increase once GE announced it was leaving. Furthermore, under the new contracts prepared by the AEC, the companies arriving to take over Hanford operations would commit themselves to investing certain sums of money into the local economy for the purpose of diversification.[29]

With these somewhat unprecedented conditions laid down, there emerged a good deal of optimism about the opportunities for broadening Richland's economic base. TCNIC was eager to accept virtually any new company that came its way, but it held out

special hope for profiting from peaceful applications of the atom. Seaborg summed up this sentiment nicely in a characterization of Hanford's principal product: "I am inclined to view plutonium as a bad child--difficult, even exasperating at times, but replete with fascinating possibilities." These words from the "father" of plutonium suggested that Richland's new economy could follow Hanford's old mission fairly closely. For communities that imagined themselves existing on an industrial frontier, it was reassuring to think that they could continue to work with cutting-edge technology.[30]

Once the policy of segmentation and diversification had been announced, it became clear that different groups being affected by the change would strive to put their own "spins" on the policy. Trying to support federal and local efforts, the state of Washington stepped forward in October 1964 with a "master plan" for statewide economic development in the nuclear and space age. This was not the Evergreen State's first effort to attract new industry related to the atom; in 1959 it had run an advertisement in The New York Times Magazine proclaiming Washington as "the place to be" for the nuclear energy industry. Now, however, in light of the cutbacks at Hanford, it accelerated the campaign with more elaborate arguments and proposals in support of nuclear power plants. The Washington "master plan" regarded nuclear energy as safe, cheap, potentially "limitless," and therefore an ideal way to attract industries to the state. The state proposed such measures as creating a more favorable business climate for nuclear industry, strengthening the state's

higher education programs in nuclear engineering, and devloping a "site for storage of nuclear by-products and waste materials." The latter effort would be housed on 1,000 acres of Hanford land leased in September 1964 by the state, from the AEC, for "a peacetime nuclear industrial park." In these ways Washington intended to make a name for itself as the "Nuclear Progress State," as one booster noted in 1971. Daniel J. Evans, the governor of the state from 1965 to 1977 and himself an engineer, spoke glowingly about the potential of nuclear power and its ability to help the state lead America in "tapping the vast frontiers of the space age."[31]

However, over these years the state did not undertake one critical task that might have helped Richland's economy diversify faster. Although Washington's research universities supported Hanford's Center for Graduate Study, Washington did not build a four-year college in the Tri-Cities, even though such an institution could have contributed a great deal to efforts to broaden the economic base.[32] And in general one might say that, while the state may have had the best intentions for the Tri-Cities, by itself it had few resources with which to affect the AEC policy of segmentation and diversification. The nuclear game was played mainly within the federal realm. TCNIC sought connections in Washington, D.C., not Olympia, because that was where the important decisions were made. Hanford remained relatively aloof from the rest of the Evergreen State.

As the largely self-appointed leaders of the local communities, the Tri-City Nuclear Industrial Council tried to

shape both diversification policies and the public's acceptance of changes at Hanford. TCNIC professed to be a conduit, merely passing along the unadorned facts to "our citizens." But in fact the council had better access to news than other organizations, and it used its special relationship with the Tri-City Herald to manage the news so as to heighten confidence in the local economy. In September of 1963, consulting engineers hired by TCNIC had advised the council to find ways to minimize "the psychological effects" of pending cutbacks. So, the day after President Johnson and Chairman Seaborg announced the closing of three Hanford reactors over the next two years, the Tri-City Herald ran stories that attempted to calm people's fears. One story, headlined "Hanford Has History of Cutbacks," hinted that the plant had absorbed similar reductions in previous years. Another story quoted the president of the Kennewick Chamber of Commerce predicting that the loss of 24% of Hanford's jobs would, "In the long run,...help to have a salutary effect in accomplishing sound diversification at Hanford."[33]

TCNIC continued this style of coverage later in the year, on the occasion of the first actual shutdown of a Hanford reactor. Writing as publisher of the Herald, Glenn C. Lee explained to Clarance C. Ohlke, director of the AEC Office of Economic Impact and Conversion, exactly how he planned to handle the news: "We will treat the layoff from the shutting down of the first Hanford reactor as a 'single story' and go no further than that....Then we will drop it." Lee further asked the AEC to send its news releases to the TCH a little earlier, because the newspaper,

which planned a carefully timed column praising AEC management at Hanford, needed more time to "get our editorial ducks in a row." Finally, Lee suggested "that General Electric officials should refrain from further comment in the community on this matter," referring apparently to a talk by one company spokesperson before the Kennewick Kiwanis Club which "has stirred up questions in the community."[34]

At times TCNIC seemed to assume the role of the AEC's guide, partner, and publicist in the Tri-Cities. In July of 1963, months before the announcement of cutbacks, Glenn C. Lee wrote AEC chairman Glenn T. Seaborg to explain that, while TCNIC still did not agree with all of the Commission's policies, the council and the Herald would both speak positively in the community about the "wonderful cooperation" received from the AEC and GE. "As we continue to write a distinct and firm record of effort and cooperation in this respect," Lee continued, "no one can complain, if some cut-backs do occur at Hanford--because everyone tried hard and cooperatively to change the total picture in the meantime."[35] Lee's implication may have been that the AEC and GE had better try to live up to the favorable image being manufactured by TCNIC and the Herald. And with Jackson and Magnuson in its corner, the Tri-City Nuclear Industrial Council was not to be taken lightly, although it did not have nearly as much influence as it sometimes assumed.

One goal behind TCNIC's efforts was to present an image of cooperation and consensus so that everybody--the AEC, GE, U.S. Senators, the state, local citizens, and Hanford employees--

appeared to be working together on diversification. With so many potential malefactors outside of this circle to worry about--including "peace-mongers," environmentalists,[36] and other states and towns competing for the same economic resources as the Tri-Cities--TCNIC hoped to keep the various players in the diversification game in line. TCNIC could not "manage" the AEC nearly as much as it hoped, however, and in addition it seldom succeeded in securing the cooperation of organized labor. When Senator Jackson visited Hanford in July 1963 to discuss the details of diversification, he assumed that the unions would eventually cooperate, but urged the AEC and TCNIC not to defer any actions on account of questions or objections from labor.[37]

Workingmen and workingwomen, however, did not simply cooperate with diversification, no doubt in large part because they expected to bear the brunt of any changes. The Herald, for example, declared in May of 1964 that the relatively high wages in the Tri-Cities ought to be reduced in order to make local investment more attractive to new businesses, and called for "cooperation" between management, labor, and community groups. Since labor was the only group being asked to give up something, it is no wonder that the unions seemed uninterested in cooperating. By summer of 1964 it was obvious that the HAMTC opposed substantial portions of the AEC program. The union had begun publishing its own newspaper, The Argus, as an alternative to TCH. Printed, appropriately, in blue-collar Pasco, The Argus seemed hostile to the diversification program. Dave Williams, business agent for HAMTC, apparently had not supported TCNIC

activities, and organized labor in general, according to Glenn Lee, did not have the proper "attitude" for attracting new industry to the area. Lee blamed unions for the community's "bad reputation from a standpoint of labor disputes and high labor costs," and wrote to Senator Jackson of the need to "straighten out the thinking of Dave Williams."[38]

As the complaints about organized labor might suggest, TCNIC and the Tri-City Herald by no means spoke for, or exerted significant influence over, all those party to or affected by diversification programs. Nonetheless, the Commission did listen to the council and to Richland citizens, and it often acted favorably upon their requests. The AEC's respect for Senators Magnuson and Jackson helped to account for its responsiveness to local inquiries. If the Commission did not reply promptly to questions from Tri-Cities residents, they were sure to appeal next to one or both Senators, who then requested a rapid written response in duplicate from the AEC. AEC officials in Washington, D.C., thus warned one another of the need to deal promptly with correspondence from the Tri-Cities. They also had learned to check with Senator Jackson before moving forward with certain initiatives.[39]

Replying to local requests was one thing, but agreeing to them was another. In implementing the policy of segmentation and diversification, the AEC followed its own agenda as much as possible. On some occasions this agenda coincided with those of TCNIC and Senators Jackson and Magnuson, but on other occasions it did not. The AEC, for example, did not wish to establish

precedents for other Commission sites by going too far beyond the bounds of "reasonable" cooperation with local efforts, so it played its hand carefully. Like the Herald, it engaged in the management of the news about the project. In January 1964 GE prepared a press release that explained its withdrawal from the Hanford project largely in terms of the prospective plight of Richland's economy and of the people to be laid off during cutbacks. The AEC thought that "overemphasis on this point can be misinterpreted," apparently because it wished to project a more limited sense of responsibility for the local community. So the Commission buried GE's press release and prepared its own explanation of segmentation and diversification, which emphasized, first, the effort to expand research activity at the Hanford Laboratories; second, the desire to encourage "commercial diversification of industry in the Tri-City communities"; and third, the pursuit of the best interests of both GE and the federal government.[40] No mention was made of the problem of unemployment.

The AEC did not want local residents and state officials to expect too much from it, but at the same time it hoped to reassure the communities about the future of the plant and to sustain their confidence in the local economy. So it made it clear that the federal government had a long-term interest in Hanford and Richland, and reminded Hanford's neighbors of the plant's safety record.[41] And, like TCNIC and the Herald, it played down the bad news.

The new policy of segmentation and diversification called forth several evaluations of the local economy.[42] These studies produced mixed results, but the AEC, perhaps with encouragement from Jackson and TCNIC, attempted to highlight the positive. When one early report (like others) did not "present an optimistic picture as regards to any substantial diversification," the AEC told Senator Jackson that it "would not be publicized."[43] At roughly the same time, an AEC-GE study group undertook an assessment of prospects for Hanford diversification. The first draft of its report was somewhat pessimistic, stressing, for example, Richland's isolated or "dead-end" location and the absence of a nearby four-year college. Somebody must have insisted upon a happier ending, however, because the slicker final draft proved significantly more upbeat. It listed no qualms about "transportation" to and from the Hanford area, and advertised its "extensive facilities for adult and advanced study."[44] Both the local communities and the businesses considering relocating to the Tri-Cities seemed to demand the most positive picture possible.

Managing the publicity about Hanford and promoting the idea of diversification were tasks that the AEC came to perform in earnest. It helped to arrange for Hanford Day on October 1 at the New York World's Fair of 1964, staged in the GE Pavilion, where Glenn Seaborg spoke in support of an exhibit promoting diversification with the title "Miracle in the Desert."[45] AEC assistance took forms other than promotion. The Commission decided to build the Fast Fuel Test Reactor (later, the Fast Flux

Test Reactor, or FFTF) at Hanford, rather than at Argonne or INEL, even though production-oriented Hanford had no design team in place for such a new reactor. It also monitored the financial health of Richland and its schools, and urged additional subsidies during the late 1960s to ensure the community's continued success. It even encouraged consideration of whether the warm water discharged from its Hanford plant might mark an improvement in local irrigation.[46]

One key resource available to the AEC was its enormous land holdings. After studying what parcels and buildings it expected to continue to use, the AEC tried to make available some of the excess acreage for "compatible" commercial, industrial, and municipal development.[47] The Wahluke Slope naturally came under further consideration. The closure of reactors through the mid- and later 1960s reduced the risks of inhabiting and working on the Slope, and TCNIC officials, local farmers, and state politicians all urged the AEC to release additional lands from its Control Zone. On July 27, 1965, the Commission announced it would permit "non-resident farming" on 40-50,000 acres of the Slope, a move that Senator Magnuson viewed as a boon to local horticulture and, therefore, a form of diversification. TCNIC echoed Magnuson's faith in farming as a staple for the future Tri-City economy. Referring to the dry lands on the perimeter of Hanford, one booster explained, "Water is all that is needed to turn these acres of sagebrush into a vast agricultural gold mine." However, in 1967 the Bureau of Reclamation decided not to irrigate the lands on the Wahluke Slope, released by the AEC in

1965, because of their inadequate drainage. Consequently, within a few more years the AEC consented to proposals from state and federal wildlife agencies to allow some hunting, fishing, and preservation in portions of the Wahluke Slope, in conjunction with plans for the adjacent river.[48]

As the arrangement with the wildlife agencies suggests, the shutdown of reactors presented chances to diversify Hanford's economy in an environmentally sensitive way, an increasingly important consideration in light of the growing environmental movement. The creation of the Arid Lands Ecology reserve (ALE) illustrated the AEC's new opportunities. In 1965 TCNIC, the Bureau of Reclamation, and nearby farmers and ranchers approached the AEC about opening the slopes of Rattlesnake Mountain, on the southwestern edge of the reservation, to livestock grazing and irrigated agriculture. The AEC did not embrace the proposal, partly because it feared that farming would disturb the underground water table, which in turn would disturb certain nuclear and chemical wastes. Also, the AEC wanted to be able to reclaim the land instantly for future use, should the need arise. Before it had answered the first request, however, it received another inquiry about the same parcel of land from scientists at Washington State University in Pullman and biologists at Battelle-Northwest Laboratories, who wanted to study "natural" ecosystems there. The AEC, without really consulting the public, preferred the scientists' much less intrusive proposal to create an arid-lands study zone at Hanford, and in July 1966 reported to

Senator Jackson its intention to pursue the idea as another step toward diversification.[49]

The AEC's decision provoked protests from local citizens. R.J. McWhorter, one of the pre-1943 owners of the acreage in question, complained in a letter to Senator Jackson that lands, if converted to an ecological study zone, would not be used for the purposes for which the Manhattan Project had acquired them, and ought then by rights to revert to their earlier owners. The Prosser Record-Bulletin repeated the concern in a March 30, 1967 editorial. It was one thing to take the land in order to build the atomic bomb there; it was quite another thing--even "un-American"--to convert the acreage "to the study of bugs" without even holding a public hearing. Besides, the Prosser editor declared, "We have no idea what ecology is."

The AEC stuck to its plans despite such criticism, and on March 29, 1967 Senator Warren Magnuson announced the creation of the Arid Lands Ecology reserve at Hanford. Dr. Ronald S. Paul of Battelle promised that the reserve would expand knowledge about man's relationship to nature, and thereby help protect the environment. In originally proposing the idea, scientists had talked of their desire for a "pristine" area of study, but the reserve was hardly unblemished. In fact, one focus of research became "Hanford plant radionuclides cycled in the local environment." One apparent aim of these investigations was to compare "the effects of [low-level] radionuclides" with the disturbances caused by other kinds of pollutants. Furthermore, devotion to ecological study was seen as a means to improve

Hanford's image. One AEC official explained in 1973 that ALE had become "an important part of our plans to establish public confidence in our site ecology practices." Finally, by studying pollution, Hanford hoped to be able to parlay its experience at environmental monitoring into new jobs.[50]

The Hanford diversification program, combined with the closure of reactors and the growing public interests in recreation and ecology, brought about new attitudes toward the lands around the reservation. Full-scale production had required AEC control over not only much of Wahluke Slope but also the Hanford Reach of the Columbia, that is, that free-flowing portion of the river between Richland and the Priest Rapids Dam. Beginning in the mid-1960s, however, the AEC began to open portions of the river to which they had previously limited access, including, in 1965, the stretch of water between Richland and Ringold. Keeping with Franklin D. Roosevelt's and John F. Kennedy's notions of "conservation," local interests regarded the liberated river as a potential economic asset. TCNIC inquired about the possibility of encouraging recreational activities on the Columbia in 1964 as part of economic diversification.[51] And in 1968 Senator Magnuson speculated that closure of reactors might permit construction along the Hanford Reach of Ben Franklin Dam, the final major piece of the Columbia Basin Project. He acknowledged that the dam would "inundate the last natural stretch of the Columbia River in the United States," but cared most for its ability to stimulate the economy. Besides, he had "received solid assurances from the Corps of Engineers that

everything possible would be done to protect and enhance the fish and wildlife potential of the region."[52]

Soon, proposals oriented more toward preservation gained precedence over economic development, largely because preservation dovetailed with a continuing emphasis on security at Hanford. In the early 1970s the AEC responded favorably to a Washington state proposal to set aside portions of the Hanford Reach as a wild or scenic area, partly because the proposal would "severely curtail public access and preserve the isolation desired [by the AEC] for the Hanford reservation." These proposals, however, worried the Commission because they might focus attention on the AEC's longstanding control over the adjacent stretch of the Columbia. The AEC Manager at Richland, Alex G. Fremling, conceded in 1973 that "our authority to close any portion of the river is, at best, tenuous."[53] The closure of reactors, coupled with the diversification effort, brought both challenges to the existing order at Hanford and opportunities to recast the AEC's mission there in a new light.

While the Atomic Energy Commission undertook some initiatives toward diversification on its own, it expected TCNIC, private businesses, and state and local government to lead the way in broadening the economies of Richland and the Tri-Cities. Studies completed in 1963-65, which were not altogether confident about the prospects for diversification, suggested some of the possible avenues for change.[54] The Tri-Cities, they said, should work to attract boaters, fishers, hunters, and other tourists to enjoy the recreational opportunities nearby. The area also stood

to benefit from continued development of agriculture and food processing. Much hope was also placed in proposals to recover "commercial fission products" from the byproducts of plutonium manufacture.[55]

Although diversification implied many changes, there were some strong attachments to the status quo that proved difficult to work around. First, as long as the AEC continued to produce fissionable material, it would insist upon reviewing proposed new enterprises at Hanford in order to ensure their "compatibility with Commission policies, authorities and activities."[56] Second, there existed a strong desire for new economic enterprises to utilize existing expertise in the work force. Local groups hoped that diversification would perpetuate the local emphasis on the nuclear industry with its relatively high salaries. Development of the program along any other lines, of course, implied greater disruption to local employees. TCNIC, other business groups, and unions hoped to keep intact the area's relatively well-paid, industrial work force. After all, three-quarters of all manufacturing employees in the three counties surrounding Hanford worked in the chemical industry (the food industry came in second place, with one-eighth). In the more narrowly defined Tri-City area, about eighty per cent of the 28,500 jobs were "indirectly or directly dependent on Hanford activities."[57] An economy that moved too far away from the nuclear industry seemed unthinkable.

The AEC and TCNIC hoped that, once GE had announced its withdrawal from Hanford, more businesses would pay attention to the Tri-Cities, and in fact the scheduled departure of the prime

contractor did increase the number of visits to the area by firms interested in moving there and bidding on the segmented operations work.[58] The real basis for diversification rested with the contracts the AEC would sign to take over the several operations areas. The AEC considered only those bidders which had indicated in their proposals exactly how, and how much, they would invest in the local economy. In some cases the AEC specified a particular diversification project, such as a plant to sort through Hanford wastes and recover commercially valuable isotopes left over from manufacturing. But the AEC encouraged suggestions for new enterprise from the bidders, too. Over the years, this program of diversification by segmented contractors met with mixed results. Some ventures flourished while other proposals never really reached fruition.

Probably the most successful segment of diversification was the transfer of GE's Hanford Laboratories to Battelle Memorial Institute, an Ohio-based, non-profit company devoted to industrial research. Battelle began negotiating its acquisition of the labs in 1964 and soon took over their operations from GE. Local citizens celebrated the advent of Battelle as critical because its research mission promised to provide a substitute for the university that the urban area lacked.[59] Over the years Battelle-Pacific Northwest Laboratories remained one of the most vital and successful diversification programs, playing a significant role in developing such additional programs such as ALE and always fulfilling its contractual commitments with the AEC to help diversify the local economy. Upon takeover of the

Hanford Laboratories, Battelle promised to invest $5 million in the local economy over the next five years, along with its annual $900,000 fee.[60]

In contrast to the development of Battelle-Pacific Northwest Laboratories, the AEC's effort to have a contractor develop an isotopes recovery plant proved less successful. In February 1965 the AEC selected Isochem, Inc., a joint venture of Martin Marietta Corp. and U.S. Rubber Co., to take over processing operations at Hanford. As part of the deal, Isochem was to invest up to $9 million to build "a commercial plant for recovery, packaging and redistribution of radioisotopes."

> Carefully packaged radioisotopes, drawn from the waste streams of Hanford's reactors, will be made available in unprecedented quantity and at sharply reduced prices. They will be used to preserve food, to sterilize medical supplies, to help manufacture chemicals, and in scores of other safe and peaceful applications....This is a dividend of the Atomic Age which our nation is only beginning to cash.[61]

Isochem took over processing operations on January 1, 1966, but within a year the company had determined that there was no market for isotopes recovered from Hanford wastes, and decided not to build its "fission products conversion and encapsulation plant." Glenn Lee regarded the decision as "a very bad shock to the community," because TCNIC had placed much hope in the idea of recycling Hanford's by-products, but found solace in the thought that "if we can replace them [Isochem] with a better company with

better diversification let's do so." The AEC accepted Isochem's decision but felt obligated, for the sake of the integrity of the diversification program and of its standing with TCNIC and Jackson, to replace Isochem with another contractor. By summer of 1967 it had chosen the Atlantic Richfield Hanford Company to take over processing operations. ARHCo also promised to invest in diversification, but the nature of its contractual commitments was telling. There was no sum devoted to a specific development of the "peaceful atom," or any other specified high-tech industry. ARHCo agreed instead to spend up to $3 million on replacing the old Desert Inn with a "hotel-convention-resort facility" that became the Hanford House; $750,000 on a "cattle feeding yard"; $1.25 million on a meat packing plant; $375,000 on the Center for Graduate Study; $400,000 in venture capital investments; and $300,000 on studies of the feasibility of "civilian oriented nuclear business in the Tri-City Area."[62]

As diversification efforts proceeded, the AEC and other observers evaluated the progress being made. At the end of 1963, prior to the shutdown of reactors and beginnings of segmentation, GE had employed 8,277 people. In May 1967, comparable contractor employment on AEC-related work, combined with employment generated by diversification efforts, stood at 8,140. This was a relatively small decrease, considering that three reactors and one processing plant had closed.[63] By 1968, the Richland Operations Office reported, $28 million had been invested in the Tri-Cities and 660 new jobs had been created as a result of the commitments made by new contractors, and it expected as many as

1600 new jobs by 1970. Diversification never created that many jobs, but by 1969 there were 942 "diversification employees," and in 1971 and 1972 there were about 1,100 jobs attributable to the diversification effort.[64]

News of Hanford's success with diversification spread. A writer for Science lauded the program, and AEC officials spoke as if the Hanford program had created a model for the government to follow in other areas hard-hit by defense cutbacks.[65] Observers reported positively about the program because most companies, such as Battelle and ARHCo, met all their obligations. However, other contractors, including Isochem, discovered that it was impossible to uphold each of their commitments. By 1968 Douglas United Nuclear and ITT had also not lived up to all their contractual obligations. ITT's performance remained unsatisfactory two years later, but, because of continuing federal cutbacks at Hanford, the AEC doubted that it could find a suitable replacement to take on ITT's work.[66] The continued closing of reactors through the later 1960s and the early 1970s naturally made TCNIC's and the AEC's jobs harder.

As might be expected, local reaction to the diversification efforts was mixed during the late 1960s and early 1970s. Labor continued to protest its impact. Robert W. Gilstrap, president of HAMTC, criticized the AEC in 1968 because union members had "sustained a disproportionate number of layoffs" while "management, supervisory, and technical people have not been required to absorb their fair share of the consequences of curtailment." Furthermore, wrote Gilstrap, the new businesses

started by diversification in the Tri-Cities did not generally employ the "experienced atomic workers" of HAMTC. ARHCo's plans for "a cattle feed lot and hotel" hardly promised to replace the high-paying jobs lost in the course of closing down reactors. Gilstrap called union workers "the forgotten men of Hanford" and scolded the AEC for rewarding neither their contributions to its mission nor the "practically irreversible commitments" they had made in order to work in the Tri-Cities.[67]

The AEC, in responding to Gilstrap's charges, essentially conceded that union members had had to suffer more than non-union employees. Between 1964 and 1968, HAMTC members had lost 880 jobs, while non-HAMTC employees had lost 380 jobs. In the former Hanford Laboratories, HAMTC workers had gained 110 jobs, while non-HAMTC workers had gained 825 jobs. The AEC also agreed that the jobs created by new contractors were concentrated in non-craft positions, but said that it could not force contractors to invest in unprofitable types of businesses.[68] The different classes in the Tri-Cities did not bear the pain of diversification equally.

The Tri-City business community proved much more sympathetic than labor to the diversification program. When shopping center developers announced the start of the Columbia Center in 1967, and then opened the mall in 1969, they cited the AEC's diversification program as a key reason for their confidence in the area.[69] The Commission's concerted effort to broaden the industrial and commercial base of the region had helped to sustain people's optimism about the local economy. Yet business

leaders refrained from pronouncing the program a thorough success. Editorials in the Tri-City Herald and letters from TCNIC to the AEC alternated between positive and negative during the late 1960s and early 1970s. Business leaders reassured the Commission and the local population that the federal effort had had a positive effect. They also remained mindful of the need for providing reassurance about the Tri-City economy. However, TCNIC and the Herald also argued that the diversification program remained far from complete, and asked the AEC and their Senators for additional assistance.[70] Boosters could not afford to tout the success of diversification too much, because they wished not to encourage complacency about the Tri-City economy, either locally or in Washington, D.C.

Despite the early successes of the diversification, definite limitations in the program inhibited its ability to satisfy either the AEC or the townspeople fully. TCNIC complained that the AEC was not committed enough to the program, that it remained too "production-minded." In this view, the AEC was criticized for not doing enough to help the Tri-Cities. At the same time, some business leaders criticized the AEC for trying to do too much. At least one prospective Hanford contractor decided not to bid on work at the site because it refused to be bound by the requirement that it also had to invest in the community. The corporate president explained this thinking to Senator Jackson:

> our decision not to proceed with a proposal resulted from the problem of business diversification in the Richland, Washington area as injected by the AEC. I do not object to action being taken to diversify business opportunities in the vicinity of the Hanford works, but as a tax payer and a company official, I have some reservations about the tying together of proposals to the AEC and diversification.[71]

The AEC found itself in the awkward position of trying to respond to pressure from all sides while pursuing a program that it may never have embraced wholeheartedly.

In addition, the AEC's strategy for diversification could not automatically transform the Tri-Cities into a more attractive site for new high-tech industry. When business representatives visited the area to consider moving some of their operations there, they pointed out that the town of Richland, like neighboring Pasco and Kennewick, still lacked many of the amenities that employees transferred from more urbane locations hoped to find. C.D. Thimsen, an executive with Computer Services Corporation, which needed to compete with other areas for high-tech employees, noted that the mid-Columbia region's isolation, inadequate communications facilities, lack of college or university, shortage of good restaurants, and scarcity of nice housing would make it difficult to recruit the necessary workers. Furthermore, the Tri-Cities still did not have ample retail facilities, so many residents continued to travel to Portland, Spokane, or Seattle to do much of their shopping.[72]

The cultural shortcomings of the Tri-Cities became particularly noticeable in 1965 and 1966, when the AEC considered Hanford as a possible home for its new 200 billion electron-volt

particle accelerator. TCNIC and Senator Jackson had urged the AEC to put some of its new or existing programs at Hanford in order to make up for the losses expected from reactor closures, and a new National Accelerator Laboratory represented one of the first opportunities to see the AEC's initiative in action. In the Tri-Cities, it seemed that Washington state was overdue to win a big, federal, high-tech project. To Senator Magnuson, Sam Volpentest wrote, "Boston got the electronics center, Houston the space center, Florida the cape and California nearly every thing else why not the A-smasher for Washington [sic]." Local boosters understood that the decision would be made in large part on the basis of which communities appealed to scientific personnel. So, TCNIC had tried to assure scientists that the Tri-Cities were "attractive to scientists, engineers, and their families" and depicted as one of their assets the absence of urban "overcrowding."[73] It is telling that local boosters continued to try to make a virtue out of the area's remoteness and isolation.

Much effort by Battelle and TCNIC to sell Hanford as a logical accelerator site came to naught, however, as the National Academy of Sciences, which the AEC had selected to make the siting decision, did not include Hanford on its short list. The main reason given for Hanford's rejection was that the surrounding region did not appeal sufficiently to scientists or "seem desirable to [their] wives and families." Regarding Hanford as an accelerator site, the Academy concluded that "The cost to the project that would result from inadequate staffing would far exceed the savings that might be realized through such

visible considerations as cheaper land, power, or water." Rather than praising the area's wide-open spaces, scientists determined that the region was not "crowded" enough. They preferred to locate the accelerator in or near a major metropolis, and did not look favorably upon having to drive four or fives hours to Seattle or Portland. By the same token, they wanted the accelerator to be located near a university campus. The University of Washington had, reluctantly, agreed to support TCNIC's proposal and be part of the acclerator effort, but the Tri-Cities still did not have its own four-year college or research university. When the decision against Hanford was announced, opinion-makers in the Northwest were bitter that their region had been passed over, and they criticized those scientific "Space Age Pioneers" who--unlike the previous generation of atomic pioneers--were unwilling to "rough it" at Hanford.[74]

The experience of bidding for the accelerator illuminated the unfavorable attitudes of many outsiders toward the Tri-Cities. That the metropolitan area had considerable cultural shortcomings challenged the residents' self-image of their "model" town. Boosters wanted to portray Richland and its neighbors as above-average communities, but the evidence suggests that many people regarded them as rather average, or worse. The AEC's designation of the site as a production center, rather than a National Laboratory or research-and-development facility, had no doubt contributed to this side of its personality. The Tri-Cities remained in some ways much too industrial to be attractive to many types of high-tech business, and as a result the progress

of diversification was slowed. Boosters hoped for particle accelerators and isotope recovery plants, but received feedlots and meatpacking plants instead.

Besides the other handicaps confronted by proponents of diversification, the AEC further weakened the local economy by continuing to shut down its production reactors at Hanford. These closures, of course, came despite the most fervent appeals by TCNIC. Late in 1966 and again early in 1967, Glenn Lee wrote forcefully to Senator Jackson to ask that additional shutdowns of reactors be postponed until 1970, so that the diversification program could "gets its roots down" and the business community could get its "feet on the ground." Lee doubted that anyone would even question the extra funds spent on Hanford:

> With the situation with Russia, Red China, the anti-ballistic missile, a $73 billion defense budget, and the uncertainty in the world today, it seems reasonable that you and the Joint Committee can argue what's a few more million dollars to keep our reactors running.

Uncharacteristically, Lee ended with a command rather than a request: "stall any change at Hanford."[75]

Not even Senator Jackson could delay the inevitable. By 1970 all but two reactors had been closed. Then on January 26, 1971 the AEC announced that, for budgetary reasons, it would shut down the final pair of reactors, KE and N, and lay off 1,500 employees. With these closings would come the eventual end of fuel-element manufacture and, ultimately, chemical processing as well--and the loss of another 500 jobs. Once again, Hanford's

reactors, and not Savannah River's, were targeted for shutdown because of their obsolete design and the fact that they produced only plutonium 239, and not enough other "isotopes of national interest such as tritium, Pu-238, Po-210, curium-244 and higher isotopes such as californium-252."[76] The news came at a terrible time for the state of Washington, which was already in the throes of The Boeing Company's most severe "bust."

This decision by the Nixon Administration, made without consulting the Washington state Congressional delegation, sparked an immediate storm of protest from the Tri-Cities. In less than three weeks, the AEC received nearly 40,000 letters opposing the decision, and the Herald had published numerous editorials denouncing the decision as a form of "political retribution" by Nixon against the state. The community expressed outrage that the government seemingly proposed to undermine, in one blow, all the careful work it had done in diversifying the economy. It also bitterly noted that Savannah River, which had not made much effort to diversify, continued to thrive and receive new assignments, while the Tri-Cities, which had toiled to diversify, were seemingly being punished for that effort. Local citizens had half-expected the shutdown of the older KE Reactor, but especially shocking was the word that the relatively new N Reactor, one of the few clear diversification successes at Hanford, was also slated for closure. The AEC had contracts to deliver power from the N Reactor to the Bonneville Power Administration. Furthermore, the region reportedly suffered at the time from a shortage of kilowatts. In essence, by proposing

to close the N Reactor, the Nixon Administration apparently intended to break the bargain between the AEC and BPA, contribute to the regional energy shortage, and nullify the progress of the diversification effort.[77] Operation of the KE reactor was halted rather quickly, but local citizens--including the Sierra Club--and the state's Congressional delegation fought hard and successfully to keep the N Reactor open, at first only for three more years, but eventually for much longer.[78]

In the aftermath of the fight over the KE and N reactors, observers paused to assess the impact of approximately a decade of segmentation and diversification. With eight out of nine reactors shut down, Hanford was in some ways but a shell of its former self. The plant's mission had changed dramatically, and efforts to transform the economy of surrounding communities had never seemed able to catch up with the closures. Local publicists tried to put the best face on all the changes. For example, a 1974 study of the Tri-Cities economy reported that in 1973 there were 5,330 more people working in the metropolitan area than there had been ten years earlier. Three things make these figures problematic, however. First, they applied to all of Benton and Franklin counties, and not simply the immediate vicinity of Hanford. Second, although the job growth represented an increase of 17.2 percent between 1964 and 1973, the statewide figure for the same period was 26.1 percent. The Tri-City area was not keeping up with the rest of Washington. Third, of the 1,220 new jobs created after 1970, 1,075 were in construction, and many of those were temporary.[79] The construction itself

represented one kind of progress--early work on additional power-generating reactors for the Washington Public Power Supply System--but it remained unclear exactly how much long-term prosperity the WPPSS project would bring to the Tri-Cities.

In fact, economic conditions in the Tri-Cities region in the early 1970s were as bleak as they were in the Puget Sound area. Unemployment increased from 9.8% in early 1971 to 10.5% in early 1972, and the local caseload for the state Department of Social and Health Services climbed to 14,000. Enrollment in Richland schools fell by 144 students between early 1971 and spring 1972, and the community voted against two school levies, one for $1.7 million and one for $ 1.5 million, in 1972, forcing the district to trim its annual budget from $7 million to $6.1 million. With the closure of KE, the total number of operating employees fell by almost 1,000 between January 1971 and January 1972. Once again, new construction picked up some of the slack, but did not offer the long-term stability once associated with Hanford production reactors.[80] G.J. Keto, an AEC official in Washington, D.C., returned discouraged from a trip to Richland in late 1971. Despite the investments made and the new jobs created, "the economic outlook is not promising." Much more needed to be done before the local economy became "relatively self-sustaining."[81]

In this period, it was hard to measure the exact impact of diversification programs. Some efforts, such as the meat packing plant, had failed, and others, such as the new hotel, had been sold to different owners, so assessing the total gains made by the community proved difficult. Regular reporting on

diversification came to an end in 1976, when only three companies holding commitments to the AEC--Battelle-Pacific Northwest Laboratories, United Nuclear, and ARHCo--continued to operate at Hanford (and ARHCo had divested itself of almost all diversification enterprises). A June, 1976 accounting of Hanford employment suggested significant changes since 1964, the year cutbacks had first been announced. Total employment at Hanford, including diversification activities, had fallen from 9,539 to 9,030, and the estimated number of employees not working for ERDA or under ERDA contracts, but working in a related or diversified job, amounted to 784, or 8.7% of the total employment.[82]

While the economy of the Tri-Cities broadened over the 1960s and early 1970s, Hanford's economy had not been diversified dramatically over the decade. Yet, given the shutdown of eight reactors since 1964, it seems remarkable that the AEC, its contractors, and the community had conspired to keep the overall, Hanford-related employment from falling further than it had. The figures attest to a community that was now much more determined to fight for itself and more experienced and skilled at pressing its claims.

Within a few years, the setbacks of the 1960s and early 1970s would fade, and another boom, based on the hope of new electricity-generating reactors, would take their place. This new spurt of growth depended in large part upon the communities' success in branching off into a civilian atomic industry. In one sense, the economy seemed to be diversifying, but in another, as became all too clear during the early 1980s, it was still not

diversified enough to avoid a continuation of the steep booms and busts that have marked Hanford's and Richland's history.

NOTES TO CHAPTER FIVE

1. ST, March 12, 1982.

2. Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Summary: Radiation Dose Estimates from Hanford Radioactive Material Releases to the Air and the Columbia River (n.p., 1994), 47-48.

3. "Production Reactors," Memo to File, Jan. 27, 1971, RDF 7:3; History Associates, Inc. (Rodney Carlisle), Production Reactors: An Outline Overview 1944:1988, prepared for the U.S. Department of Energy, Office of New Production Reactors (Washington, D.C., 1992).

4. An overview of TCNIC's first decade is provided by Christian Calmeyer Fleischer, "The Tri-City Nuclear Industrial Council and the Economic Diversification of the Tri-Cities, Washington, 1963-1974" (M.A. thesis, Washington State University, 1974). The study depends rather uncritically on TCNIC's view of things, and probably overestimates the council's influence and success.

5. JGT, Master Plan for Richland Washington, ??; "Atomic Cities' Boom," Business Week (December 18, 1948):70.

6. Minutes of RCC, Nov. 16, 1953, Jan. 14, 1954, April 4, 1955.

7. "News in Brief," Nucleonics 16 (June 1958): 27.

8. "Town That Wouldn't Stay Down," U.S. News and World Report 59 (July 19, 1965):96.

9. Ted Van Arsdol, "Richland Diversification (and trends toward civilization)," MS of statement to Industrial Review Committee of the Atomic Energy Commission, Richland, WA, June 11, 1962, in Special Collections, UW Libraries, 1-3, 5-7.

10. Van Arsdol, "Richland Diversification," 4-5; Fred Clagett, "AEC Hearings," June 9, 1962, FCP; Murrey W. Fuller, "Presentation to A.E.C. Committee on Behalf of the City of Richland," June 17, 1962, FCP.

11. AEC, "Report on AEC Cooperation in Industrial Development Efforts of Communities Such as Richland, Washington, and Oak Ridge, Tennessee," Nov. 1962 [hereafter cited as Slaton Report], 58-66Sec 1329:13, pp. 1-3; J.E. Travis (on "moral obligation") cited in Jerry E. Bishop, "Unique Plan Launched To Convert Big A-Bomb Plant to Peaceful Use," Wall Street Journal (October 1, 1964):10; "Diversification Through Segmentation," special issue of Hanford Project News (GE), December 30, 1965,

FCP; William H. Slaton to Clarence C. Ohlke, Feb. 19, 1964, RDF 4:1.

12. Slaton Report, 8, 10-11, 13-14.

13. John T. Conway to Henry M. Jackson, Nov. 5, 1962, HMJP-3, 88:5; Glenn C. Lee to Jackson, Nov. 28, 1962, HMJP-3, 88:5; Lee cited in Thomas P. Murphy, Science, Geopolitics, and Federal Spending (Lexington, Mass., 1971), 448. Chapter 14 in Murphy's book, "Closing Down Hanford's Reactors," examines the origins of diversification and segmentation. The author sent a draft of it to Senator Jackson's office for review (HMJP-3, 114:14).

14. The Henry M. Jackson and Warren G. Magnuson Papers contain much, often quite detailed correspondence between the Senators and Tri-City business leaders that evinces a pattern of considerable knowledge of and influence on AEC policies and practices at Hanford.

15. P. G. Holsted and F. W. Albaugh, The Potential for Diversification of the Hanford Area and the Tri-Cities (Richland, WA, 1964):1; Robert F. Philip to Glenn T. Seaborg, March 11, 1963, 58-66Sec, 1329:13; TCH, Feb. 5, 1963, Oct. 1, 1964
Glenn Lee had an interesting history with the AEC. In 1949 the SSR (July 25, 1949) identified this "youthful publisher of the Tri City Daily Herald" as a "vehement critic of AEC and G.E. policies" at Hanford and the source of some Congressional criticisms of Hanford operations. Apparently, Lee had not been able to get ample space in government-leased Richland for his newspaper offices, and accused the AEC of being deliberately unresponsive to him in retaliation for his criticisms. Lee said, according to SSR, that the AEC and GE were running Richland "101 per cent with their plutocratic socialistic monopoly."

16. On the influence of TCNIC see: Murphy, "Closing Down Hanford's Reactors," 18-19; Memo to files (author unknown), February 25, 1970, "Subject: Telephone interview with Mr. Luther Carter, Science Magazine on Feb. 24, 1970," RDF 3, p. 2; Edward Bauser, "Remarks by Captain Bauser at the Annual Meeting of the Tri-City Nuclear Industrial Council at Pasco, Washington," January 15, 1975, RDF, 3.

17. Fleischer, "TCNIC and Economic Diversification," 142, 46. On the Herald's role as local booster, see Cassandra Tate, "Letter from 'The Atomic Capital of the Nation,'" Columbia Journalism Review 21 (May/June 1982):31-35.

18. Fleischer, "TCNIC and Economic Diversification," 42-43. On Jackson's July, 1963, visit to Richland, see Paul G. Holsted to Brian Corcoran, July 15, 1963, RDF 4:4; James T. Ramey to Seaborg, July 18, 1963, RDF 4:4.

19. TCH, Feb. 5, 1963; Sam Volpentest to Warren G. Magnuson, May 8, 1964, WGMP-4, 232:23.

20. Volpentest to Magnuson, May 8, 1964. Campaign contributions are covered by Fleischer, "TCNIC and Economic Diversification," 93; Luther J. Carter, "Swords into Ploughshares: Hanford Makes the Switch," Science 167 (March 6, 1970):1361 (qtn.).

It is of interest to note that the Senators' staffs paid fairly close attention to local coverage of Jackson and Magnuson. Glenn Lee sent two clippings from the TCH to Magnuson's office in late 1965. One fairly long article featured snapshots of Jackson, Seaborg, and the presidents of companies newly selected to be Hanford contractors, but it had no picture of Magnuson. One of Magnuson's assistants wrote, "These boys are always after the boss and staff here about something, but I don't see Senator's pic in the leaflet." "JR" to Carl [Downing], memo, n.d. [around late December, 1965], WGMP-4, 241:37.

21. TCH, June 6, 1969. The AEC had become careful always to show consideration for Jackson's interests and constituents in the previous decade, after his involvement in the issues of disposal and the Wahluke Slope. See, for example, the memo of John S. Graham to W.B. McCool, April 7, 1958, 51-58Sec 1280:4.

22. Memo to Files, "Subject: Telephone interview with Mr. Luther Carter, Science Magazine on February 24, 1970", 1.

23. On the "surprise," see Robert F. Philip cited in TCH, Oct. 1, 1964. As early as September of 1963, a consulting engineer hired by TCNIC wrote of "probable cutbacks in production activities." See Frederick H. Warren, "Prime Factors in Aiding Economic Diversification at Hanford," Sept. 4, 1963, RDF 4:4

24. AEC, "Report on Segmentation and Diversification Program," November 20, 1968, 3; Glenn T. Seaborg, "Statement," Jan. 8, 1964, AEC press release, RDF.

25. "Plutonium Town," 82; Robert F. Steadman, Memo for Secretary of Defense, July 23, 1963, in 1969 file concerning reactor shutdowns, HMJP-4, 85:4.

26. As early as 1950, the AEC complained that reactor development efforts at Knolls deprived Hanford of "GE talent," where it was more needed. Transcript of Gordon Dean Office Diary, March 17, 1950, EHC.

27. Murphy, "Closing Down Hanford's Reactors," 15; Fleischer, "TCNIC and Economic Diversification," 26; Don Shadinger (GE employee) to Jackson, July 8, 1967, HMJP-4, 56:1; Lee to Jackson, Nov. 28, 1962.

28. Correspondence of Glenn C. Lee, June and July 1963, in 58-66Sec 1329:13; Warren, "Prime Factors in Aiding Economic Diversification at Hanford."

29. W. E. Johnson, "Memorandum: Hanford Diversification," January 21, 1964, RDF 4:1; Leonard F. Perkins, "Impact on an Operations Office of Changing Operating Contractor, or Segmentation at Hanford with DT's," talk at Idaho Falls, October 6, 1965, RDF 4:3, pp. 3-4; AEC, "Report on Segmentation and Diversification Program," 4; E.J. Bloch, "Status of Segmentation and Diversification Activities at Hanford," Memo, March 31, 1964, RDF 4:1, p. 2.

30. Seaborg cited in "Plutonium Town," 82; TCH, May 9, 1965. On the extent to which the segmentation approach was unprecedented, see Bishop, "Big Plan Launched To Convert Big A-Bomb Plant to Peaceful Use," 1; Perkins, "Impact on an Operations Office of Changing Operating Contractors, or Segmentation at Hanford with DT's," 1, 14.

31. Donald Fielding Koch, "Master Plan: A Program for the Development of the State of Washington in the Nuclear and Space-Age," October 1964, RDF 9:4; New York Times Magazine, Sept. 27, 1959; TCH, Sept. 10, 1964, in RPL-Richland-Industries; Joseph L. McCarthy, "The Evolution of Enabling Legislation for the Thermal Power Plant Site Evaluation Council," September 16, 1971, transmitted by Lawrence B. Bradley to James R. Schlesinger, October 4, 1971, RDF 9:4, p. 3; Evans cited in TCH, Jan. 13, 1965.

32. Holsted to Ohlke, April 16, 1965, in "Richland--Joint Center for Graduate Study 1965-1971" file, RDF:7.

33. TCH, Oct. 1, 1964 (on presenting facts honestly), Jan. 9, 1964 (for upbeat coverage of cutbacks); Warren, "Prime Factors in Aiding Economic Diversification at Hanford." As to TCNIC's better access to news, see the complaint from a Yakima newsman to Senator Jackson that the Tri-City Herald received preferential treatment from Washington's Congressional delegation in receiving word of new developments at Hanford; Thomas Bostic to Jackson, Sept. 7, 1967, HMJP-4, 56:10.

34. Lee to Ohlke, Dev. 7, 1964, in Ohlke Memo, Dec. 14, 1964, RDF 4:2.

35. Lee to Seaborg, July 17, 1963, 58-66Sec, 1329:13.

36. Lee, "Remarks by Glenn C. Lee--Governor's Council--Richland, February 2, 1966," RDF 4:3, p. 1. A TCH editorial of March 31, 1967, criticized environmentalists by disputing claims that Hanford's thermal discharges harmed Columbia River salmon by comparing the claims to the "emotional...hysteria" surrounding the damage done by dams to the salmon runs.

37. Holsted to Corcoran, July 15, 1963, RDF 4:4; Ramey to Seaborg, July 18, 1963, RDF 4:4.

38. TCH, May 19, 1964; Lee to Ohlke, June 26, 1964, in Ohlke to Bloch, July 9, 1964, RDF 4:2; Lee to Ohlke, Dec. 7, 1964, in Ohkle memo to files, Dec. 14, 1964, RDF 4:2; Lee to Jackson, Sec. 13, 1963, HMJP-3, 88:13.

39. A.M. Waggoner to Frank Thomas, Oct. 2, 1969, RDF 5:7; "F-Reactor as a Historic Landmark," in "Briefing Data--Richland, for Chairman Seaborg's March 29, 1967 visit," March 1967, RDF 4:10.

40. General Manager to AEC, Jan. 14, 1964, RDF 4:1; AEC General Manager memo to files, Jan. 14, 1964, RDF 4:1.

41. J. E. Travis, "Remarks by J. E. Travis at Dinner Honoring Seattle Civic and Business Leaders, with Tri-City Area People in Attendance--at Desert Inn," April 24, 1963, FCP.

42. "Diversification at Hanford Means Planning and Finding New Businesses Today for Tomorrow's Needs," General Electric News [HAPO], November 8, 1963, pp. 4-5; Holsted and Albaugh, Potential for Diversification of the Hanford Area and the Tri-Cities; P.G. Holsted and F.W. Albaugh, Hanford Capabilities (Richland, WA, 1964); Battelle Memorial Institute [hereafter BMI], Summary Report on Economic Analysis of the Tri-County Area (Columbus, 1964); EBS Management Consultants, Inc. [hereafter cited as EBS], Comprehensive Plans for the Urbanizing Areas of Benton County, Washington (San Francisco, 1965).

43. Bloch to Henry M. Jackson, April 23, 1964, RDF.

44. Compare Holsted and Albaugh, Potential for Diversification of the Hanford Area and the Tri-Cities, to Holsted and Albaugh, Hanford Capabilities, March 1964.

45. TCH, Oct. 1, 1964, Travis memo, Nov. 12, 1964, RDF 4:2; Glenn T. Seaborg, "Diversification at Hanford; Remarks...for Hanford Day at the World's Fair," Oct. 1, 1964, RDF 4:2.

46. "Richland--Fast Fuel Test Reactor," RDF 5:6; "Assistance Payments to the Richland Community and Schools," in "Briefing Data--Richland, for Chairman Seaborg's March 29, 1967 Visit," RDF 4:10; TCH, Nov. 17, 1968; AEC files on warm water irrigation, RDF 13:9-11.

47. TCH, May 15, 1963, in "Excerpts from Local Press Comments on AEC Efforts to Assist in Diversification and Encourage Industrial Development at Richland (Following March 15, 1963)," 1964, RDF 4:1, p. 2.

48. TCH, July 26, 1965; Lee to Seaborg, April 6, 1964, E.E. Miller to F.P Baranowski, July 13, 1964, and "Richland--Wahluke Slope" files, all in RDF 13:1-2; Fleischer, "TCNIC and Economic Diversification," 111 (qtn.).

49. This and the following two paragraphs come from: "Richland--Arid Lands Ecology (ALE)--1965-1968" file, RDF; "Richland--Arid Lands Ecology Reserve (ALE)," in "Briefing Data--Richland, for Chairman Seaborg's March 29, 1967 Visit," RDF 4:10; TCH, March 29, 1967.

50. Alex G. Fremling to G.J. Keto, Dec. 31, 1973, RDF 5:5; Richland Operations Office and its Operating Contractors, "A Proposed Study of the Hanford Complex as a Site for a National Environmental Pollution Study Center (NEPSC)," May 1969, HJMP-4, 85:3.

51. Ohlke to Philip, Oct. 23, 1964, RDF; Keto to R.E. Hollingsworth, June 23, 1971, RDF 3:5.

52. Draft statement by Magnuson, in Donald A. Pugnetti to Carl Downing, June 4, 1968, WGMP-4, 232:26.

53. Carl Patzwaldt et al., "Ad Hoc Committee Draft of A Proposal for Management of Public Use of Portions of Hanford AEC Reservation," Oct. 23, 1973, in Alex G. Fremling to Keto, Dec. 31, 1973, RDF 5:5; Fremling to Keto, Dec. 31, 1973, RDF 5:5.

54. "Diversification At Hanford Means Planning and Finding New Businesses Today for Tomorrow's Needs," 4-5; Holsted and Albaugh, Potential for Diversification of the Hanford Area and the Tri-Cities; Holsted and Albaugh, Hanford Capabilities; BMI, Summary Report on Economic Analysis of the Tri-County Area; EBS, Comprehensive Plans for the Urbanizing Areas of Benton County, Washington.

55. BMI, Summary Report on Economic Analysis of the Tri-County Area, 3, M-3, M-4; Holsted and Albaugh, Potential for Diversification of the Hanford Area and the Tri-Cities, 5.

56. Addendum stapled to Holsted and Albaugh, Hanford Capabilities, front inside cover.

57. BMI, Summary Report on Economic Analysis of the Tri-County Area, C-1; "Diversification At Hanford," 4-5.

58. "22 Firms Express Interest in Operations at Hanford," Nucleonics Week 5 (May 28, 1964):1.

59. BMI Summary Report on Economic Analysis of the Tri-County Area, 1; TCH, Jan. 1, 1965.

60. Fleischer, "TCNIC and Economic Diversification," 65-66. Battelle did not start moving the laboratories away from military-related research. Under GE, the Hanford Laboratories were doing "more work on the peacetime applications of atomic energy than in support of the weapons program" by 1962. TCH, June 20, 1962.

61. TCH, Feb. 9, 1965; Isochem, Inc., Isochem at Hanford (Richland, WA, n.d.; RPL-CF-Richland--Businesses 1940-1970 file), 6.

62. TCH, Jan. 19, 1967, in RPL-R-Businesses 1940-1970 file; Glenn Lee to Brian Corcoran (in Senator Jackson's office), Jan. 23, 1967, HMJP-4, 56:8; Richland Operations Office, AEC [cited hereafter as ROO-AEC], "Report on Segmentation and Diversification Program," Nov. 20, 1968, RDF 4:5, pp. 5-6, Appendix p. 4.

The entry of the Atlantic Richfield Hanford Company into the feedlot and meatpacking businesses elicited protest from local businessmen who disapproved of what they perceived as government subsidy to a large corporate competitor in the region. The protests did no good. See correspondence in HMJP-4, 56:8, 10.

63. E.W. Johnson to Jackson, July 12, 1967, HMJP-4, 56:11.

64. ROO-AEC, "Report on Segmentation and Diversification Program," 9-10; Memo to Files, Feb. 25, 1970, "Subject: Telephone interview with Mr. Luther Carter, Science Magazine," 2; AEC, "Staff Report: Economic Conditions in Richland, Washington," April 26, 1972, RDF 9:4, p. 1.

65. Carter, "Swords into Ploughshares," 1357; Ray Bloomberg, "Letter from Hanford: AEC's Baby Begins to Flex Commercial Muscle," Nucleonics Week, Dec. 5, 1968, pp. 6-7.

66. ROO-AEC, "Report on Segmentation and Diversification Program," 6-9; Hudson B. Ragan to Keto, Feb. 1, 1971, RDF 4:6.

67. Robert W. Gilstrap to Donald Williams, Jan. 26, 1968, in D.G. Williams to H.T. Herrick, Feb. 8, 1968, RDF 4:5.

Gilstrap's remarks echoed the complaints of T.J. Deen, president of Local 369 of the International Chemical Workers Union, about "the lack of jobs being provided for bargaining unit people through the diversification efforts of the successful bidders in the Hanford Atomic Products Operations Diversification Program." Deen argued that workers' long service and loyalty to the Hanford Atomic Works "entitle[d] them to something better than an unconditional layoff." Deen to Jackson, Feb. 27, 1967, HMJP-4, 56:8.

68. Williams to Gilstrap, Feb. 7, 1968, in Williams to Herrick, Feb. 8, 1968.

69. TCH, April 4, 1967, Oct. 14, 1969.

70. Memo to Files, Feb. 25, 1970, "Subject: Telephone interview with Mr. Luther Carter, Science Magazine," 1; Philip to James R. Schlesinger, Nov. 10, 1971, RDF 4:6.

71. Glenn Lee to Jackson, Dec. 21, 1966, HMJP-4, 56:8; John Logan to Jackson, April 28, 1967, HMJP-4, 56:8.

72. C.D. Thimsen to Fred Clagett, Feb. 21, 1968, FCP; Lee to Jackson, Dec. 21, 1966.

73. Battelle-Pacific Northwest Laboratories, "Special Report: Hanford as a Site for Large Accelerators," January 1965, WGMP-4, 232:23; Volpentest to Magnuson, May 25, 1965, WGMP-4, 241:38; TCNIC to Paul McDaniel, June 9, 1965, WGMP-4, 232:23. The debate over the siting of the accelerator is covered nicely in Murphy, Science, Geopolitics, and Federal Spending, ch. 10.

74. Fleischer, "TCNIC and Economic Diversification," 93-110; clipping from Seattle Argus, n.d., in Lee to Magnuson, April 19, 1966, WGMP-4, 241:37; Lee to Magnuson, April 19, 1966, WGMP-4, 241-37. When Magnuson made a Senate speech criticizing selection of Weston, Illinois (outside Chicago) as the site for the new accelerator, the Herald editorialized approvingly. TCH, July 23, 1967, clipping in HMJP-4, 56:10.

75. Lee to Jackson, Dec. 21, 1966, Jan. 23, 1967, and Lee to Brian Corcoran, Jan. 23, 1967, in HMJP-4, 56:8.

76. "AEC to Shut Down Last Two Production Reactors at Hanford," AEC press release, Jan. 26, 1971, RDF 7:3; "Questions and Answers on Hanford," included in "AEC to Shut Down Last Two Production Reactors at Hanford," p. 12.

TCNIC and Washington's Senators fought--apparently with some success--to postpone reactor closings. See, for example, Henry M. Jackson to Richard M. Nixon, Feb. 28, 1969, Glenn T. Seaborg to Jackson, April 14, 1969, Volpentest to Jackson, April 15, 1969, all in HMJP-4, 85:4.

77. John C. Ryan to Hollingsworth, Feb. 12, 1971, RDF 7:3; TCH, Jan. 31, 1971; P.M. Boffey, "Hanford's reactors down but not out," Science, 171 (February 12, 1971):555; D.A. Snyder to Seaborg, Jan. 30, 1971, RDF 6:9.

Although the N Reactor was still fairly new in 1971, it, too, was regarded by some as obsolete. An official in the Nixon Administration contended that the N Reactor was not very safe. It did not meet AEC standards of reliability and safety for commercial reactors, and it did not have to because it was operated by the AEC on AEC lands. The official called N "a sloppy engineering job" and characterized it as subject to too many breakdowns. Presciently, he also suggested a more important priority at Hanford than the dual-purpose reactor--80 million gallons of "high-level radioactive liquid waste" that needed to be "managed." NYT, Feb. 7, 1971.

78. "Hanford KE and B+N Reactor Shutdown" files, RDF 7:1-2. The Sierra Club was "greatly concerned about the environmental effects of proposed new reactors," but opposed "the closure of existing ones, where they are producing electric power in quantities such as that produced by the one at Hanford." (Better

an existing reactor than a new dam on the Columbia?) Brock Evans to Jackson, Feb. 12, 1971, HMJP-4, 114:14.

79. Marvin Clement et al., "Study and Forecast of Tri-City Economic Activity and its Related Impact on Gasoline Needs and Housing" (Richland, WA, May 1974), 31, 36. See also TCH, April 11, 1972.

80. TCH, April 11, 1972; AEC, "Staff Report: Economic Conditions in Richland, Washington," April 26, 1972, RDF 9:4, pp. 1-3.

81. G.J. Keto to William O. Doub, Dec. 3, 1971, RDF 6:1; Keto, "Report on Trip to Richland Operations Office," draft, Jan. 3, 1972, RDF 6:1.

82. Fremling to Keto, March 12, Aug. 25, 1976, RDF 4:6.

CHAPTER SIX

Changing Missions and Changing Communities: Hanford and the Tri-Cities, 1970-1993

For many people closely associated with Hanford, the site's "best" years--that is, its time of greatest utility, greatest prosperity, and greatest acceptance--occurred in periods of national crisis. Hanford and the Tri-Cities had expanded the most, and contributed the most to the country, during America's mobilization for World War Two and the Cold War. Consequently, when the AEC shut down eight of Hanford's nine reactors between 1964 and 1971, it was perhaps natural for the surrounding towns to try to mobilize Hanford anew in order to meet other national crises.

Between the late 1960s and the early 1990s, community leaders proposed Hanford as part of the solution to three pressing problems faced by the United States. First, from the later 1960s through the early 1980s, they promoted the site as a major contributor to the resolution of America's "energy crisis." This prospective mission entailed the construction of electricity-generating reactors and associated facilities at Hanford and Richland. In the grandest vision, Hanford would become a "nuclear power park" of twenty or more reactors. In reality, only one power reactor, besides the dual-purpose N Reactor, was completed. Second, during the Reagan defense buildup of the 1980s, Hanford reverted to the mission of plutonium production, and in so doing resumed its role on the

Cold War homefront. Third, while the nation became increasingly strident about environmental matters, Hanford undertook new efforts throughout the 1970s, 1980s, and early 1990s to store and manage wastes generated by the nation's nuclear industry. In the early 1980s, Hanford hoped in particular to become the main repository for the nation's highly radioactive wastes. That opportunity did not materialize, yet as it turned out the site already had plenty of its own nuclear wastes to occupy its attention fully in the coming years. As Hanford concluded its fiftieth year of operation in 1993, the mission of environmental restoration had become its overarching concern.

Storing and managing wastes at Hanford, however, proved for several reasons to be a tricky mission. For one thing, waste management at Hanford did not readily offer the same kinds of rewards that plutonium production had. For another, some outsiders remained skeptical that the agencies and people that had helped to generate wastes were the best choice for the assignment of cleaning them up. In addition, the politics and technologies of waste management remained very frustrating, and seemingly contained as many pitfalls as opportunities for the local economy and culture. Indeed, the existence of an immense amount of waste at Hanford, and the record of its management and mismanagement over the years, provoked increasing public criticism. The waste itself, in other words, became a national crisis, so that Hanford was cast in the public mind as a problem rather than a solution to a problem.

Consequently, Hanford and the Tri-Cities at times seemed outcasts, at odds in some way with the rest of the country. Local attitudes perhaps helped encourage the perception of polarization between the Hanford community and outsiders, for it was commonly held that the rest of the country, and especially western Washington, did not appreciate sufficiently Hanford's achievements or capabilities. Debates over Hanford's status and significance ultimately revolved around investigations and interpretations of its history, as critics and defenders offered their versions of the site's development, contributions, and liabilities. These investigations and interpretations have been pursued not only among historians and journalists but also in scientific studies and in lawsuits. The outcome of these studies and lawsuits will, in a sense, constitute the final chapter of any history of Hanford's first fifty years.

The changes to Hanford's mission and reputation after 1970, of course, did not occur in a vacuum. A number of regional, national, and international developments transformed the context in which Hanford and the Tri-Cities operated. The Cold War itself dragged on, then ended quickly. The nation's attitude toward energy in general changed, and its confidence in nuclear power in particular declined. Confidence in government and big science, which had crested after the Manhattan Project, also declined. The environmental movement grew to a size unimaginable in the 1960s. And the Atomic Energy Commission itself disappeared. From January 1975 to October 1977, the Energy Research and Development Administration administered Hanford, and

since then the Department of Energy has been the supervising agency. Furthermore, federal authority over the site was increasingly divided, so that decisions by the Bonneville Power Administration, Nuclear Regulatory Commission, and Environmental Protection Agency increasingly affected on the site. Similarly, the state of Washington, the Yakima Indian Nation, and other non-federal entities, including activist groups, gained an increasing voice in affairs at Hanford. That the DOE now invites public input into and comment on major decisions indicates how much things have changed since the day of the Manhattan Project, when only a handful of individuals across the country knew what went on at Hanford.

* * *

In the later 1960s and the 1970s, Hanford and the Tri-Cities mobilized to help solve America's energy crisis. The creation of the N Reactor, of course, had already marked one step toward realizing the idea of power production, and by the early 1960s supporters of nuclear energy had begun to predict a regional shortage of electricity if more power-generating facilities were not built. Both the AEC and Tri-City business leaders had been promoting nuclear plants for years, arguing that they would ultimately provide cheaper, cleaner, and more energy than coal or hydroelectric power.[1] They also embraced nuclear power plants as an integral part of their diversification strategy because they seemed to offer an opportunity for the fewest economic disruptions as Hanford moved from its old mission to a new one.

Forecasts of an imminent shortage of electricity in the Pacific Northwest appeared to make additional power plants a matter of national urgency, especially during the peak years of America's energy crisis in the early and mid-1970s. It was widely argued that the nation needed roughly to double its power supply every decade. Failing to meet this target would endanger its security and its economy. Congressman Chet Holifield of the Joint Committee on Atomic Energy, speaking at Richland in 1970, made what became a staple prediction. America's population would increase by fifty percent from 200 million to 300 million by the year 2000. In order to maintain an adequate standard of living, the society needed to generate by 2000 seven times as much electricity as it produced in 1970, and do so in a "safe, reliable and economical" fashion. Holifield expected nuclear power plants to provide the majority of the new electricity. In 1970 they accounted for only 2 percent of American capacity; in 1980, he predicted, they would have to provide 50 percent.[2]

When phrased in these terms, the nation's need for new electricity amounted to a crisis, an energy crisis which was compounded during the early 1970s by geopolitical turmoil in the Mideast that threatened America's supply of oil from that part of the world. Senator Henry M. Jackson, in a speech delivered at Richland's Rivershore Motor Inn during October 1972, evoked a sense of the energy situation by comparing it to war.

> This community was born of crisis--World War II. To find an answer to bring that war to an end as fast as possible. That was 1942-1943. And now, 30 years

later, we face another crisis, which a lot of people don't understand. The Energy Crisis.[3]

Hanford and the Tri-Cities had played an important role in solving the first crisis, Jackson averred, and now they stood "uniquely equipped" among American communities "to play a major role in providing a solution" to the second crisis. Because environmental and economic issues now cast doubt upon the long-term future of fossil fuels, the Senator explained, there was an urgent need to explore the potential of nuclear power and nuclear power parks. Recommending "a massive effort of research and development" in the area of nuclear power, Jackson urged the nation to "marshall our talents and our resources with the same kind of dedication and energy that we did in making possible the Manhattan Project in World War II."[4]

Rhetoric such as this reminds one of exactly why so many in the Tri-Cities adored Jackson. His words not only reminded them of their golden, pioneering years of the 1940s and of Hanford's previous contributions to the country, but also identified still another national crisis which the people of the Tri-Cities could help solve. Furthermore, his mention of the Manhattan Project and the need for a "massive effort of research and development" hinted that lots of federal funding would, or at least should, be forthcoming to support the Tri-Cities as they blazed new trails along the energy frontier. At a time when reactor shutdowns had lowered community morale and endangered local prosperity, Jackson not only offered hope for economic recovery but also reassured the people of the Tri-Cities that Hanford--and, by implication,

they--constituted a "national asset," as the Herald phrased it. Or, as Glenn C. Lee of TCNIC wrote, because "We could play the entire nuclear ball game at Hanford and the nation could get a lot of credit for starting such a trend," Hanford would remain "a 'showcase in the nation.'"[5] Despite the changes of the 1960s, many key elements of the Tri-Cities self-image remained intact.

Believing nuclear power to play a crucial role in Americans' energy future, community leaders in the Tri-Cities saw their task as one of ensuring that Hanford got its share of the new electricity-generating reactors that had to be built. Just as there had been with planning for Grand Coulee Dam during the 1920s and 1930s, there existed in eastern Washington an assumption that local development of a new source of energy would of itself attract more population and industry to the region.[6] Richland expected to expand both because it would develop a large civilian nuclear industry and because the power plants themselves would recruit additional, non-nuclear businesses seeking to reduce their costs by locating next to a source of electricity. However, as opposition to nuclear power plants surfaced west of the Cascade Mountains, the arguments for siting the plants at Hanford changed slightly. Boosters continued to portray the Tri-City communities as a main source of nuclear expertise and therefore a logical place to build new reactors. But by the late 1960s community leaders had also begun to promote the Tri-City area as a kind of regional sacrifice zone.

This long-lived line of thinking emerged in a series of Herald editorials in 1969 and 1970. As part of regional power

planning, new reactors had been proposed for western Washington and Oregon. But over time opposition developed to sites west of the Cascades. In May 1970, for example, voters in Eugene decided against continuing with a new reactor for their municipal power supply. The Herald's response was that the environs west of the mountains could be protected from the nuclear threat by building all new reactors on the east side, where the absence of much opposition also meant that the urgent work could be completed more quickly. In arguing for protection of the more populated western side of the region and its greater variety of scenery, the Herald conceded that nuclear power continued to present considerable health and environmental risks.

> The alternative is to place the plants east of the Cascades, away from population centers, and where prevailing winds blow from, instead of toward, the cities. Transmission costs might increase Northwest power bills fractionally but the additional cost would be a low price to pay to protect our environment--and our people....[And,] what about the other costs? The cost of damage to marine life from heated water dumped into Puget Sound? The cost in human misery of super-saturating an atmosphere already dripping? The cost of "polluting" magnificent sea and mountain scenery with transmission towers?...[The people] have a right to choose between slightly higher cost of electricity and irrevocable damage to our environment.[7]

New reactors, as well as nuclear parks, belonged "on federal land areas, particularly in the West."[8] This view perpetuated the view, also expressed by the U.S. Army when it built Hanford during World War Two, that the interior West was the best place to put a potentially hazardous technology because it was somehow an empty region.

The Herald's editorial viewpoint accepted as fact many of the criticisms that outsiders had made and would continue to make regarding both nuclear power and the Tri-Cities area. Nuclear power did present certain risks, and for the sake of local economic gain the Herald believed it would be safer to locate those risks in eastern Washington, which it implied was a rather unattractive hinterland. Dumping heated or radioactive water into Puget Sound was discouraged, but diverting it into the Columbia River was acceptable. Building nuclear power plants upwind from Seattle or Tacoma (but not Walla Walla or Spokane) was ill advised. In certain respects, the Herald was merely parroting the westside's somewhat negative attitudes toward both the mid-Columbia region and nuclear energy. It was also adopting the venerable strategy of many western economic hinterlands which had been willing to tolerate the risky byproducts of extractive industry in order to secure economic gains.

Of course, it is doubtful that residents of the Tri-Cities, or even the Herald's editors, fully accepted the views expressed in the editorials. Many residents of the area, for example, had become quite attached the region and would have defended its amenities against what western Washington had to offer.

Furthermore, although the editorials used some environmentalist arguments to support removal of power-plant projects from the west to the east side of the Cascades, the Herald did not truly take many environmentalist ideas very seriously. Indeed, the newspaper had already begun to warn against the influence of environmental activists, a theme that continued through the 1970s and 1980s.[9]

People in the Tri-Cities no doubt took much more seriously the other arguments on behalf of nuclear power. Seizing upon projections of imminent shortages of electricity, the Tri-City Nuclear Industrial Council pointed out that the Northwest could not afford further delays in building new plants. While people in Eugene or Seattle might well postpone construction by arguing against nuclear power and its risks, the Tri-City population was assumed to offer "the precious ingredient of 'Public Acceptence'" [sic] which would facilitate rapid progress. It also offered expertise and experience with nuclear power. And the communities, in contrast to the more heavily populated coastal areas, contained more room in which to grow. R.F. Philip wrote that siting new plants at Hanford would "help relieve current industrial and population congested areas in the Pacific Northwest through transfer of industry which, in turn, could improve their existing environment."[10]

As Tri-City residents offered Hanford as the best place in the region to build new power reactors quickly, safely, and sensibly, they also promoted the possibility of developing a "nuclear power park" of numerous reactors and related facilities.

This idea, first promoted in the early 1960s as Tri-City leaders began to consider the possibilities inherent in diversification, gained clearer focus in the later 1960s and early 1970s. Once again proposing to explore a technological frontier for the rest of the nation, leaders in the community envisioned a planned and coordinated arrangement, like a scientifically oriented industrial park, wherein a variety of reactors and their supporting operations would co-exist. In 1971 R.F. Philip of TCNIC listed elements of the concept to the new AEC chairman:

> onsite location of a number of nuclear power plants, fuel preparation and reprocessing facilities, isotope recovery and encapsulation capability, nuclear waste disposal facilities, and other nuclear-related services and activities, such as laboratories, tube fabrication for nuclear fuel, and a nuclear-oriented labor market.

In 1970 the Richland City Council considered building a municipally operated power plant as "the first addition" to the proposed nuclear park at Hanford.[11]

The Atomic Energy Commission warmed only gradually to this idea. In 1965, as most production reactors at Hanford continued to operate, it discouraged the notion of a "commercial nuclear industrial park" because it could not allow civilian activities to interfere with Hanford's military-oriented mission. Three years later, however, AEC chairman Glenn T. Seaborg spoke enthusiastically at Richland's 25th anniversary celebration about a "Nuplex" or "nuclear-powered industrial complex." He imagined that an industrial park organized around nuclear power plants

would allow for the healthful segregation of industry from cities, thereby returning the metropolis to "people" and reducing its pollution. Should the Tri-Cities collectively undertake such a development, he predicted, they would by 1993 "probably be a large metropolis thriving on its growing science-based industries. Perhaps Hanford will be its Nuplex, able to preserve the surrounding vast and majestic area close to the way nature created it."[12]

As Hanford's mission of plutonium production diminished, AEC support for the idea of a nuclear park gathered strength. By 1970 the managers of the Richland Operations Office had determined that a nuclear park would be "compatible with continuing AEC operations" and begun speaking in support of local efforts to develop one. The AEC did not want to give people the impression that it would subsidize a nuclear park, but it did support the concept as part of its efforts at bolstering the local economy and co-operating with Tri-City citizens. "While the program for diversification at Richland appears to be proceeding well...," it noted in 1971, "the anticipated results have not yet fully materialized." People laid off as a result of the shutdown of production reactors continued to face unemployment. Furthermore, the AEC expressed concern that the Pacific Northwest had had trouble "securing sites for nuclear power plants." Finally, managers at the Richland Operations Office championed a nuclear power park in 1970 as something that "would help promote AEC's image in a positive way in its desire to develop nuclear power."[13] Nationwide study of nuclear parks

(later renamed "energy centers") continued through the 1970s because people viewed them as a form of "rational planning of energy production," even after opposition to nuclear power had become sizeable.[14]

During the late 1960s and the 1970s, then, local business leaders as well as the AEC shared confidence in the concept of a nuclear power park as a key to the future well-being of Hanford and the Tri-Cities. Consequently, when they received proposals for other activities, they considered them in the context of their likely impact upon the proposed nuclear power park. Two environmentally oriented endeavors--wilderness preservation and waste management--were evaluated in terms of their prospective relationship to a nuclear power park.

With the shutdown of eight production reactors between 1964 and 1971, interest had turned to the fate of lands lying adjacent to the Hanford site. Some of the nearby territory was given over to agriculture, but the AEC seemed to prefer that adjacent land be converted to different kinds of wilderness areas (the Arid Lands Ecology reserve, for instance, and the hunting, fishing, and recreation areas across the Columbia River from Hanford) because the agency wished to limit the amount of economic development and population growth on the perimeter of where it continued to conduct some operations. Thus it did not object too strenuously when a group calling itself the Columbia River Conservation League urged that the stretch of river between Richland and Priest Rapids Dam known as the Hanford Reach--the last "free-flowing" segment of the Columbia between Canada and

Bonneville Dam--be set aside as a national scenic river or a national recreation area.[15]

The Conservation League showed political savvy in its proposal. It conceded that "the Hanford reservation impinges upon the natural beauty of this stretch of the Columbia River," but it was much less concerned about the AEC site than about the prospect of the Army Corps of Engineers building its proposed Ben Franklin Dam, a project sure to destroy the Hanford Reach of the river. The League went on record as preferring nuclear plants to a dam as new sources of electricity. Furthermore, it aimed not to provoke opposition from Tri-City business leaders. Its proposal went to considerable lengths to show how its suggestions for preservation would not conflict with--and even might complement--the development of a nuclear power park:

> Establishment of a National Recreation Area would not preclude further nuclear development on the inner portion of the Hanford reservation. With careful, coordinated planning, additional power reactors, such as Hanford Number Two and the potential Hanford Number Three could be operated with minimal encroachments or impact on the Columbia River. The inner portion of the Hanford reservation could be developed into a model nuclear park, while the outer portion of the reservation could be designated a National Recreation Area or its equivalent. The combination of a National Recreation Area and Nuclear Park provides a unique

> opportunity to demonstrate that development can coexist with natural areas.[16]

Proponents of a nuclear power park responded in different ways to proposals for preservation of natural areas along the Columbia. Local business leaders were concerned above all with economic growth. TCNIC did not oppose the possibility of tourists, sportsmen, and sportswomen visiting the Hanford Reach, but it wanted to make sure that preservation of that segment of the river did not interfere with the proposed nuclear power park.[17] The nuclear park loomed large in the Council's estimation not only because of its local economic importance but also because TCNIC assumed it would become a critical source of electricity for a region facing a short supply of energy. In separate letters, Robert F. Philip and Glenn C. Lee of the Council warned how the Conservation League's proposal threatened to interfere with the "orderly development" of the river:

> We want Hanford to be developed as a nuclear park...and we want to move up and down that river and in and out of that area with barges and equipment and utilize the Hanford area for its highest and best use for all of the residents of the Pacific Northwest, not just a few people who want to watch birds or catch fish.[18]

AEC officials seemed generally sympathetic to the views of Tri-City business leaders, perhaps because the Commission had a vested interest in the success of a nuclear park. They also seemed unwilling to encourage an increasing number of visitors to the vicinity of the Hanford site, which continued to require a

considerable amount of security. So they took no favorable action on the Conservation League's proposal, and justified their decision by saying that, through the AEC's agreements with the State of Washington Department of Game and the U.S. Bureau of Sports Fisheries and Wildlife to manage the shoreline along the Wahluke Slope, most of the League's conservation goals had already been attained.[19]

While opposing the Conservation League's proposal, however, the AEC apparently took note of its confident assurance that a nuclear park and a natural area could coexist. Because the Commission's mission at Hanford revolved increasingly around the politically sensitive matter of waste management, it was in the AEC's interest to encourage citizens' confidence in its environmental policies and behavior. Hoping to "allay public criticism of our site ecology practices," as one official put it, the AEC began to promote its own program for creating, with Battelle-Pacific Northwest Laboratories, a "National Environmental Research Park" along the Hanford Reach. This idea emerged within one year of rejecting the scenic-river proposal, and it clearly attempted to improve upon the earlier initiative by keeping all control of the proposed research park in the hands of the AEC and its contractor, rather than in the less reliable hands of state or federal game management.[20] Nothing came of the AEC's proposal, either.

The AEC had become more concerned about reassuring the public about its "site ecology practices" during the early 1970s not only for the purpose of encouraging public approval for

additional nuclear power plants but also for the purpose of minimizing criticism of its treatment of wastes. Like the construction and operation of new reactors, the management of wastes was believed to constitute an economically rewarding dimension of a nuclear power park. Among early suggestions for diversification of Richland's economy was a proposal that Hanford become a leading site for "radioactive waste disposal," and over the years this activity was promoted as a source of employment to help make up for jobs lost due to reactor closings. Through the 1970s a variety of local and state officials championed Hanford as the nation's best choice for developing a waste management site.[21] Management of wastes generated by the site's decades of plutonium production remained a constant activity and challenge.

Yet for all the talk about the river and radioactive wastes, communities around Hanford remained most concerned with the development of new reactors. Both economically and psychologically, nuclear power plants seemed the best substitute for the production reactors that had been shut down. After years of seeking new plants, the Tri-Cities virtually realized their dream during the 1970s when the Washington Public Power Supply System (WPPSS) decided to build three electricity-generating reactors at Hanford. The ensuing planning, construction, and operation brought another considerable boom to Hanford, and promised fulfillment of the aspiration for a diversified nuclear economy for the area.

The story of the rise and fall of the Supply System has been told at length elsewhere.[22] Here it seems important to emphasize

the project's general impact upon the Tri-Cities. A continuing close attachment to nuclear energy sustained the towns' self-image as cutting-edge communities on America's technological frontier. Even as the fascination with nuclear matters began to wane around the country, the Tri-Cities continued to bask in their identification with the atom. Herald headlines continued to refer to Richland as "Atomic City" or "A-City." Mike McCormack, the area's longtime Congressman, went by the nickname "Atomic Mike."[23] This identification with things nuclear persisted even in the wake of the incident at Three-Mile Island in 1979, as the country grew more skeptical of nuclear power. One Seattle columnist dubbed Richland "the Ellis Island of the nuclear age. Send us your harrassed and embattled reactors, says the local chamber of commerce. They are welcome here."[24]

Richland and its neighbors remained ready and able to coexist with the risks and byproducts of atomic energy. They explained their stance in part by arguing that the nation needed their commitment. To "reject nuclear energy," the Herald editorialized again and again, "is to condemn ourselves and our children to a lower standard of living."[25] Where fascism and communism had once been the enemies against which Hanford mobilized, now it stood up to threats to the nation's affluent way of life. The community (if the Herald is any reflection of its views) tended to assume that nuclear power was inevitable because there was no better alternative for generating the additional energy that Americans would need. "The move to nuclear power is irreversible," argued the Herald. "Whatever the

dangers, real or imagined, of nuclear power, the overriding reality is that it's gone beyond the point of no return."[26] Once again, the people in the Tri-Cities perceived that they had aligned themselves with the future as pioneers on the technological frontier. And by implication, those who opposed more electricity-generating reactors were probably just tilting against the inevitable. Yet if activists should somehow succeed in stopping or delaying new nuclear plants, they would endanger the nation's and the region's future: "The alternative to nuclear power is stagnation and a non-growth economy."[27]

The Tri-Cities also continued to embrace nuclear energy because it promised the least disruptive economic future for the area. The three plants begun by the Supply System promised to keep in place the skilled workforce that had been recruited to the Tri-Cities by employment opportunities at Hanford. They also promised to advance significantly the program of broadening the economy that had started in the early 1960s. By 1980, with three WPPSS reactors under way at Hanford, journalists were proclaiming that diversification at Hanford had proven "highly successful," and Tri-City residents believed that their accomplishments could "serve as a model elsewhere." At the same time, however, they had reason to doubt that very many "elsewheres" existed out there that were likely to follow the Hanford model. The Tri-Cities featured an unusual combination of "wide-open spaces," expertise, and, most important of all, widespread support for nuclear development, that enabled them to take advantage of opportunities

that, by the later 1970s and the 1980s, most other communities preferred to bypass.[28]

The metropolitan area's embrace of nuclear power and radioactive waste management must have been economically rewarding but culturally isolating. In taking on the mission of generating nuclear power for the Pacific Northwest, Hanford was proposing to do the region's bidding, rather than the nation's bidding, in the future. Rather than serve as the secretive site of work for the defense establishment, Hanford would now produce kilowatts for cities, towns, and farms throughout the region. Rather than answer to Washington, D.C. as it had in the past, Hanford would now answer to the public utility districts of Washington state. Producing nuclear power, it was thought, would make Hanford and the Tri-Cities more important to and integrated with the rest of the region; other Northwest communities would become more directly interested in what went on in the mid-Columbia area. WPPSS offered a chance for Hanford and the Tri-Cities to become more like--and more liked by--other places in Washington. But this opportunity did not turn out as hoped.

The nuclear orientation of the Tri-City economy did generate a satisfying amount of expansion during the 1970s. During the previous decade the growth of the three communities had been modest. Kennewick's population increased over the 1960s by 6.8 percent and Richland's grew by 11.6 percent, while Pasco's declined by 4.1 percent. Over the same period, the size of the overall labor force grew by only 10.6 percent, from 20,817 to 23,029. During the next decade, however, growth came much more

dramatically. Pasco's population increased by 28.9 percent, Richland's by 27.7 percent, and Kennewick's by 126.1 percent. Between 1970 and 1980 the size of the labor force in the three cities virtually doubled. (See Table Six.)

Table Six:[29]
Tri-Cities Population Growth, 1960-1980

	Pasco	Kennewick	Richland	Tri-City Labor Force
1960	14,522	14,244	23,548	20,817
1970	13,920	15,212	26,290	23,029
1980	17,944	34,397	33,578	43,739

While the numbers of people in the Tri-Cities changed substantially, the distinctions between the three towns did not. Pasco remained the least prosperous and most diverse. It retained the smallest percentage of owner-occupied housing, the lowest per-capita income, and the highest level of unemployment. Its minority population dwarfed those of its neighbors. The African-American population of Pasco grew from 1,334 (9.6 percent) to 1,414 (7.9 percent) during the 1970s, and the number of Hispanics jumped from 534 to 3735. In 1980 Hispanics amounted to more than one-fifth of the town's population.[30]

By contrast, Richland during the 1970s retained the highest per-capita income and the lowest unemployment level of the Tri-Cities. By 1980 the numbers of the town's African Americans (471) and Hispanics (714) had increased, but together the two minorities comprised only 3.5 percent of Richland's population. Furthermore, in percentage terms, Richland's population grew the

least over the decade, and consequently by 1980 it had by far the highest median age within the urbanized area.[31] Once the AEC disposed of the town, new housing there had taken on a much lower density. So even though Richland had annexed significant amounts of new territory during the 1960s, it began to run out of room for new housing during the 1970s, and the price of existing housing increased rapidly.[32]

Most of the area's newcomers during the 1970s headed for Kennewick, which by 1980 had become the largest of the Tri-Cities. (It was also the least diverse, with only 1.1 percent of its population either African-American or Hispanic). Kennewick grew rapidly in part because it had fewer limits to gaining a new housing supply, and many construction workers recruited for the WPPSS projects of the 1970s ended up in the town. Kennewick also expanded because, with the continued development of the Columbia Center shopping mall, it had acquired dominance in Tri-City commerce. (Partly because of the mall, fewer residents of the area felt they had to drive to Portland, Spokane, or Seattle to shop, and more people from south-central Washington consumed in the Tri-Cities.) According to the 1980 census, Kennewick housed the lion's share of both construction and retail workers in the urban area.[33]

On the basis of the recent growth, the Tri-Cities felt optimistic about the future in the early 1980s. A Herald editorial on New Year's Day of 1982 listed the reasons to be confident. WPPSS had nearly completed one nuclear power plant at Hanford and, the Herald was sure, would finish the two others

begun there. The newspaper also expected Puget Sound Power and Light Co. to start building two of its own nuclear generating plants at Hanford during the coming year or two. The election of President Ronald Reagan promised as well that Hanford would again do more defense work. Furthermore, given all the attention shown the site by the DOE, Hanford seemed to be "a cinch to be chosen as the site for permanent storage of nuclear waste" from around the country. The Herald interpreted all of these prospects, of course, as an affirmation of the abilities of the local population and a tribute to "the can-do attitude of our people."[34]

For those who shared the Herald's optimism, the rest of the decade would prove to be quite a surprise. Beginning in 1982 and continuing for the next several years, Hanford received a number of shocking blows that essentially undermined the basic missions that the Herald regarded as sure things in 1982. The blows also threatened to ruin the Tri-City economy.

The first blow was the collapse of plans by WPPSS to complete all three of its reactors at Hanford (as well as its other two at Satsop in Grays Harbor County). The troubles faced by the Supply System did not begin in 1982. By the late 1970s it was becoming clear that the demand for new electricity would not be as high as people had predicted in the early and mid-1970s when the five reactors were conceived.[35] In other words, the short-term need for the reactors came into question. Additionally, the cost overruns on the projects were enormous--the total bill had skyrocketed from $4.1 billion to $23.8

billion--while management of the reactor construction had proved inadequate. Only one source of the soaring expenses was disagreement between labor and management. A nine-month plumbers' strike in 1976 and a work stoppage of five-and-a-half months in 1981 helped not only to drive up costs but also to give Hanford a "nationwide reputation for labor problems and for low productivity."[36]

The weight of debts and delays finally proved too heavy for the Supply System. In 1981 it announced a moratorium on the construction of two of its five reactors; in 1982 it terminated work on four of its plants; in 1983 it defaulted on its bonds, the largest default on municipal bonds in financial history. The only completed reactor, WPPSS No. 2, began producing electricity in 1984--seven years later than initially planned.[37]

The Supply System's problems brought the Tri-City boom to an immediate halt. Unemployment in the urban area jumped to about sixteen percent in 1982, and the vacancy rate for apartments reached forty percent. The construction trades were hit hardest; membership in the carpenters' union local soon fell from 2,600 to 500. By 1985, the unemployment rate had fallen to about nine percent, but that was in large part due to the fact that so many people had left town. The labor force had fallen by 11,300 people, almost one-quarter of its 1980 size.[38]

In retrospect it is clear that WPPSS collapsed primarily of its own weight and not because of anti-nuclear activism.[39] The public, however, was becoming increasingly skeptical of nuclear power, and its changing attitudes toward environmental issues did

place limits on the kinds of opportunities available to the Tri-Cities in the nuclear field. Anti-nuclear activism enjoyed some success in the mid- and late 1970s outside of Washington, but inside the state support for the nuclear industry had remained fairly high. For most of their terms as governor, for example, Daniel J. Evans (1965-1977) and Dixy Lee Ray (1977-1981) encouraged proposals for other states to ship their nuclear wastes to Washington. This willingness to serve as a waste storage site soon disappeared, however. In 1980 Washington voters passed by a three-to-one margin an initiative to ban the import of non-medical nuclear waste. A U.S. court soon declared this initiative unconstitutional, because it interfered improperly with the federally regulated sphere of interstate commerce. Yet the measure did indicate the extent to which Washington--which had once dubbed itself the "Nuclear Progress State"--had changed its mind.[40] The shift in attitudes ensured that in the coming years the Tri-Cities and the rest of the state would no longer see eye to eye on matters nuclear.

If most Washington voters objected to the idea of their state taking on more of the nation's radioactive waste, the Department of Energy and citizens in the Tri-Cities did not. Both the federal government and local business leaders had envisioned waste management as an integral part of economic diversification at Richland, and throughout the early 1980s their interest continued. In 1982 the U.S. Congress, in the Nuclear Waste Policy Act, decided to select two sites, one east and one west of the Mississippi, as repositories for 77,000 tons of the

nation's highly radioactive wastes. Although the DOE officially considered ten sites around the country, through 1984 it had spent more than $300 million "studying Hanford's basalt [as a potential underground storage facility] while virtually ignoring most of the other sites." This keen interest apparently stemmed in part from the perception that Washingtonians--or at least the state's elected officials--were more receptive to the idea of a repository than the people of other states.[41]

Yet statewide support for the proposal was hardly forthcoming. A 1986 poll conducted by the Tacoma News Tribune determined that 71.9 percent of the state's population opposed putting a national waste repository at Hanford, while only 15.7 percent supported the proposal. Within the Tri-Cities, by contrast, supporters of the proposal outnumbered opponents, 46.5 percent to 32.0 percent.[42] The figures provided an indication of the extent to which the mainstream of state opinion on nuclear issues had diverged from attitudes in the Tri-Cities.

Around the state and around the nation, the growing doubts about nuclear energy and nuclear wastes found political support, and thereby affected Hanford's future. These changes in attitude came at a time when Hanford was particularly vulnerable in government. In the 1940s and 1950s the site's critical role in the nation's mobilization for World War Two and the Cold War gave it unprecedented strength. Yet even as its part in the nation's defense diminished during the 1960s and 1970s, it remained able to withstand some serious setbacks, due in large part to its political connections. Senators Warren G. Magnuson and Henry M.

Jackson toiled to protect the interests of Hanford, helping, for example, to ensure a federal commitment to diversification. In the early 1980s, however, these two Senators left office. Magnuson lost his bid for re-election in 1980, and Jackson died unexpectedly in 1983.

Suddenly, Hanford no longer had two enormously powerful U.S. Senators working on its behalf. At least one of the replacements, Slade Gorton, did continue to lobby hard for Hanford interests, but doing so hurt him politically in 1986 when his opponent, Brock Adams, defeated his bid for re-election in part by campaigning against Gorton's record of supporting too strongly what Adams dubbed Hanford's "bomb factory." Once in office, Adams was accused by people in the Tri-Cities of "betraying fundamental pork-barrel allegiances" because he did not support projects considered beneficial to Hanford, as Magnuson, Jackson, and Gorton had done.[43]

It is not certain that Jackson and Magnuson, had they served longer in office, would have been immune to the environmentalist concerns that increasingly motivated Washington voters to criticize Hanford. As the 1986 Senatorial race between Adams and Gorton demonstrated, Hanford now tended to polarize rather than unify the electorate. Yet it does seem likely that, more than their successors, Magnuson and Jackson could have deflected some anti-nuclear pressures while continuing to serve Hanford's interests in the nation's capital. As it was, local leaders lamented the loss of their "watchdog in Washington, D.C." Sam Volpentest of the Tri-City Nuclear Industrial Council explained

the new situation in 1985: "Things don't operate like they used to, when you could just call up Scoop or Maggie."[44]

Still another blow came in 1985 when the DOE decided to reorganize and streamline Hanford operations in order to save money. Assuming that the program of segmentation and diversification had run its course, the DOE proposed reducing the number of Hanford contractors from eight to four, thereby eliminating a projected six-hundred administrative positions. The Department did not wish to require bidders for the new contracts to invest in the Tri-City economy, but it was compelled to reverse its position. However, unlike the previous solicitations of bids, it left the amount and nature of local investment up to individual companies interested in working at Hanford. Late in 1986 the DOE announced that the team of Westinghouse and Boeing had won the $5-billion consolidated contract for Hanford operations, beginning in 1987. The winning bidders promised to invest more than $10 million in the Tri-City economy over the five-year life of the deal.[45] So, against the DOE's initial wishes, a program of diversification remained in place at Hanford, but it continued only within an overall context of consolidation and cost-cutting.

While changes in the nuclear power industry, in voters' attitudes, in state politics, and in DOE policies would all constrain the opportunities available to Hanford, their full force would not be felt until 1986 or so. This was because, in the early 1980s, the Reagan Administration began another defense buildup which called for additional plutonium production from

Hanford. As work on the Supply System reactors stopped and Washington citizens grew more critical of proposals for storing additional wastes in the state, Hanford geared up again to resume its Cold-War mission. Through the 1970s, the amount of federal money spent at Hanford on military needs had declined. For about ten years, 1972-1982, the N Reactor ran "on a cycle that produces plutonium for energy research rather than weapons." Between 1982 and 1983, all of this changed. The bulk of spending reverted to military activities as the N Reactor "shifted back to bomb-grade plutonium." In 1983 the DOE also reactivated the PUREX (or Plutonium Uranium Extraction) plant, which had been shut down for a decade.[46]

In the mid-1980s, then, Hanford remained as much a federal enclave as it had ever been. With the termination of all but one WPPSS reactor project, the effort to diversify the economy with an industry centered in Washington state remained far short of its goal. The two main hopes for Hanford's economic future--plutonium production and management of the government's radioactive wastes--perpetuated both the site's affiliation with U.S. defense programs and the Tri-Cities' "addiction to political decisions and congressional appropriations," as the Herald put it. Thus, while thousands left the region after the deflation of the WPPSS boom, employment by DOE and its contractors remained steady at around 13,000.[47] Among the three towns of the urban area, this employment pattern favored Richland, the DOE headquarters, over Kennewick and Pasco.

The renewal of Hanford's Cold-War mission must have been satisfying to some. Again, the site's brightest days had been associated with its mobilization on behalf of national defense. Furthermore, in the early 1980s most people expected that the Cold War would continue for decades. In this expectation, however, they were wrong. By the late 1980s the Soviet Union and its empire in eastern Europe had begun to implode, causing some to question America's need for production of additional nuclear weapons. Yet even before the destruction of the Berlin Wall in Germany and the breakup of the Soviet Union, Hanford's contribution to the Cold War was coming to a close. Late in 1986 the N Reactor was shut down, following the Chernobyl disaster in the Ukraine. After lengthy study of the plant's flaws and projected costs, the DOE decided in 1987 and 1988 not to restart it. The closure of N was predicted to result in a loss of up to 6,400 jobs (and perhaps another 7,800 to be affected indirectly). The PUREX plant was similarly shut down in December 1988, and not restarted, and in 1989 the Plutonium Finishing Plant followed suit. Hanford's mission of plutonium production had come to a close. (Also in 1987, the Basalt Waste Isolation Project was terminated at Hanford, costing another 1,200 jobs; the DOE now focused its attenion on Yucca Mountain, Nevada--over the objections of Nevada's governor--as the preferred site for its main repository for high-level nuclear waste.)[48]

The demise of the Cold War changed everything about Hanford's prospects, and left it without much future as a production facility. The community had long identified itself

with working reactors--those that produced plutonium for weapons; those that produced electricity for civilians; and those that contributed to business and research. By the late 1980s there was no more demand for weapons-grade plutonium from Hanford. Similarly, there was little demand for new, electricity-generating reactors in the United States. On top of that, Hanford's Fast Flux Test Facility (FFTF), conceived as a tool for energy research and the peaceful atom, also seemed to have no purpose any longer. Originally a test reactor for the DOE's breeder reactor program, which Congress had killed in October 1983, FFTF had been in search of a mission for years. Ultimately, the DOE could find no cost-effective use for this reactor, one of its newest; in the early 1990s, invitations to other countries and private companies to invest in FFTF produced no proposals to which the DOE could agree. Consequently, the Fast Flux Test Facility, too, was placed on cold standby in early 1993. In a letter to U.S. Senator Slade Gorton, the Secretary of the Department of Energy, retired Admiral James Watkins, explained that the DOE no longer needed the reactor for producing plutonium-238, a fuel for battery packs used by NASA, because it "has now concluded negotiations to purchase plutonium-238 from the Russians at a cost far less than production in FFTF."[49] Ironically, Hanford's last federally-supported reactor was put out of business, in part, by the former Soviet Union's atomic complex, the very complex against which Hanford had mobilized for so long.

As the world cheered the end of the Cold War, nuclear facilities around the globe wondered what the future held. In both the former Soviet Union and the United States, towns built and subsidized by their respective national defense establishments now looked for ways to transfer their skills and resources to civilian, peacetime, global markets. At certain American atomic sites, such as Los Alamos and Livermore, which had a greater scientific infrastructure in place, this transformation would prove difficult enough.[50] It would prove even more challenging at production facilities such as Hanford, which had never been designated a National Laboratory or developed close ties to a research university, which remained unattractive to many businesses that might otherwise have considered investing in the area, and which had an enormous burden of nuclear wastes with which to cope.

With the end of Hanford's production of plutonium for America's nuclear weapons, there ensued two struggles to define the site. The first revolved around its future: What, if anything, would Hanford become, now that it was out of the bomb-making business? As it turned out, this first question was intimately tied up with the second, which concerned Hanford's past. In the later 1980s and the 1990s, people increasingly debated Hanford's legacy. In particular, they investigated, argued, and went to court over the impact, over time, of Hanford's production on the health and environment of the Pacific Northwest. Moreover, people investigated, argued, and went to court over the fate of the extant, on-site wastes that had been

generated during previous decades. Management of these wastes, and environmental remediation of the site, became Hanford's new mission--but not without resistance and controversy.

With the shutdown of the N Reactor in 1986-87, the question of Hanford's future mission loomed large. The community's preference, as expressed through the Tri-City Herald, seemed to be for some new, cutting-edge technology, preferably in the realm of production. A newspaper editorial of October 1986, for example, urged that the government accept a controversial proposal that it take over WPPSS No. 1, "a partially completed nuclear power plant," and convert it "into a dual purpose defense reactor that would produce plutonium and tritium as well as electricity." And the following year, when threatened with the loss of the N reactor, the Herald reiterated the need for a "replacement reactor" of some kind.[51] Similarly, the idea of becoming a national repository for the nation's most dangerous nuclear wastes appealed to local communities primarily because it implied new research and development. With another reactor or a cutting-edge environmental project, Hanford might hold on to its position on America's technological frontier.

What seemed less attractive was the apparently more mundane prospect of managing Hanford's own wastes. By one estimate, the site had "about two-thirds of the nation's total volume of waste involved in the production of nuclear weapons," a sum that made Hanford a "contender for the title of 'most polluted place on earth.'"[52] At least a few observers calculated that cleaning up these wastes, or otherwise managing them, represented "the only

long-term, full-employment solution" to the region's economic problems. Yet many local citizens resisted this new emphasis. For one thing, the insistence that Hanford had to deal with its own wastes came from outsiders--including Seattle residents, environmentalists, and anti-nuclear activists--who were not trusted in the Tri-Cities. For another, the Hanford community had invested a lot in assuring people, including itself perhaps, that the wastes were not very dangerous, and therefore possibly not truly worthy of priority attention. For still another, Tri-City residents doubted that waste clean-up by itself--without a "replacement reactor" of some kind--would provide them with economic stability: "Because if Hanford becomes merely a waste site with ample clean-up funds," the Herald warned, "it will soon become a waste site with next to no funds at all...."[53]

Moreover, the tasks associated with waste management, such as "chasing hot tumbleweeds" across the site or monitoring old storage tanks, did "not fit with the image of a seamless engineered environment that Hanford folk aim to create." Mike Fox, a nuclear engineer, explained why the new mission did not sit well with those who remained committed to the old.

> We've been asked to become janitors for the DOE when we could be more professionally satisfied being on the cutting edge of technology....You can't overstate the demoralizing aspect of taking away high technology activities and asking us to become paper-pushers and janitors.

Many at Hanford remained oriented to life on the frontiers of industrial production. They viewed the site as a contributor to solutions to national crises, and not as a problem in itself. In 1985 Jerry White, the DOE's "director of waste technology," had put the subject in local perspective when he said, "We're tired of managing the waste. We want to put it in a position where we can walk away and never bother with it."[54]

As a mission for Hanford, waste management did not have the appeal of plutonium production, electricity generation, or energy research. However, during the later 1980s the Department of Energy, under Secretaries John Herrington and James Watkins, was changing its priorities to reflect new political and geopolitical realities. Faced with the fact that its facilities around the country for producing America's nuclear arsenal were too old and too prone to pollute, it steadily moved away from weapons as a focus and placed greater emphasis on health, safety, and the environment.[55] At Hanford, the new direction crystallized in May of 1989 with the signing of the Hanford Federal Facility Agreement and Consent Order (or Tri-Party Agreement) between the DOE, Environmental Protection Agency, and State of Washington. The deal promised that the Hanford site would be cleaned up within thirty years at a cost of at least $57 billion. It also made the public a full partner in the process by soliciting its input on a regular basis.[56]

Implementation of the Tri-Party Agreement proved enormously complex and troubled. The technologies and resources for managing the wastes were not as forthcoming as had been hoped,

and controversy ensued when certain deadlines for clean-up had to be postponed repeatedly. There was speculation that the DOE, at least when signing its clean-up agreements around the country, had not really been committed to carrying them out. Moreover, at least one investigation of the effectiveness of the clean-up effort, five years after it had begun, found significant waste of money but little technical and environmental progress.[57] The delays, frustrations, and increasing costs worried those committed to clean-up, who feared with good reason that "taxpayers will become impatient with the pace and cost of the cleanup and give up...." Locally, the clean-up effort also produced economic anxiety because, if the DOE carried out its intention to hire a new "Environmental Restoration and Management Contractor," it might well "dirsupt the economy of the Tri-Cities by ousting stable union jobs and replacing them with specialists retained to do specific tasks."[58]

Yet, despite its problems, the agreement at least promised a long-lasting, productive activity with which the Tri-Cities could recapture economic vitality. It also required that highly complicated scientific and engineering problems be solved, thereby offering Hanford an opportunity to remain on the cutting edge of technology. Finally, the agreement provided a framework in which the various differences between the the federal government, the Tri-Cities, and the other peoples of Washington could continue to be resolved. During mid- and late 1993, the signatories of the Tri-Party Agreement began to renegotiate the entire pact in order to develop a more realistic plan for clean-

up.[59] The original agreement had been neither permanent nor perfect, but it did provide a common point of discussion and departure, and a flexible framework for negotiation, for the many organizations concerned about Hanford's future.

The new focus on waste management met with eventual acceptance at Hanford. Some residents of the area embraced the new mission fully, saying that they appreciated the chance it offered to be part of a solution to a problem, rather than part of the problem. For many in the Tri-Cities, accepting the new mission entailed recognizing simultaneously that the old mission would no longer do. "Huge community resources and tremendous amounts of dwindling political currency have been expended to preserve a defense mission for Hanford," the Tri-City Herald editorialized in 1990. "It isn't working and likely won't."[60] Others in the Tri-Cities yielded only grudgingly to the changed mission, because it differed so starkly from what they had done before and because they were not sure what part--if any--they would play in the new day. In addition, because the change came at a time of tremendously mounting criticism of the site and its past practices, some people felt particularly compelled to protect or defend what Hanford had once been and had once done.

Much of the growing criticism of Hanford stemmed from widespread concerns about the effects of plutonium production on public health and the environment between 1944 and 1971, as well as from the realization that during the Cold War the federal government had not been altogether forthcoming about the dangers Hanford had presented to its neighbors. Early in 1986 the DOE

released 19,000 pages of documents detailing some of the story of the site's radioactive emissions. This was just the first in a series of releases to the public of previously classified data describing the impact of Hanford emissions on surrounding populations and environs. By 1990, the DOE reached a historic turning point when it conceded, according to the New York Times, that Hanford's emissions during the 1940s and 1950s had been high enough to cause cancer and other illnesses in residents of the Pacific Northwest. The data also indicated that the AEC had in many instances known about the emissions--and sometimes even planned them, as in the case of the infamous "Green Run" of December 1949--without taking steps to inform the public.[61]

The DOE's recognition that its plants had likely affected the health of people off-site stemmed in large part from the work of the Hanford Environmental Dose Reconstruction Project. This effort produced a series of reports which culminated during the spring of 1994 in Summary: Radiation Dose Estimates from Hanford Radioactive Material Releases to the Air and the Columbia River. Plutonium production at Hanford had released to the atmosphere a variety of radioactive isotopes, the leading six of which had produced more than an estimated 744,000 curies of radioactivity between 1944 and 1972. The most important of these had been iodine-131 which accounted for 739,000 curies by itself, mostly in the years 1944-1951. (An estimated 555,000 curies had been released via iodine-131 in 1945 alone.)[62]

Humans living downwind from Hanford absorbed radioactive iodine in a variety of ways, but the most important was through

milk and dairy products. The amounts or doses of radioactivity absorbed by humans varied according to age, diet, and distance from Hanford. Children absorbed higher doses than adults; people who drank milk from cows on fresh pasture absorbed more than those who bought dairy products at the store; and families living right next door to Hanford, including in Richland, absorbed more than those living farther downwind, say in Spokane or Lewiston, Idaho, or in places that were mostly upwind from Hanford, such as Ellenburg or Yakima. Thus a "maximally exposed" child who grew up in a "maximally exposed" place (that is, a child who drank milk from cows on fresh pasture and lived at Ringold, just east across the river from Hanford), absorbed an an estimated median dose of 235 rad to the thyroid between December 26, 1944 and December 31, 1951 (the median dose would have been 110 rad for a child consuming commercially available foods); in the same period, an adult in the same place consuming milk from cows on fresh pasture would have absorbed a median estimated dose of 36 rad to the thyroid. By contrast, a maximally exposed child in Ellensburg would have absorbed a cumulative, estimated median dose to the thyroid or 2.1 rad (a child consuming commercially available foods would have had a median dose of 0.09 rad), while a maximally exposed adult there would have abosorbed a median dose of 0.01 rad.

The air pathway resulted in much higher doses of radiation to the body than the river pathway. Yet, Hanford releases of radiation to the Columbia River between 1944 and 1971 accounted for more curies of radioactivity than atmospheric emissions. The

five main radionuclides discharged to the river, as determined by the Hanford Environmental Dose Reconstruction Project, produced an estimated 22,000,000 curies between 1944 and 1971, with the vast majority being released between 1950 and 1971 and the peak emissions between 1955 and 1965. Radioactive materials released into the river made their way into the human body primarily via the consumption of fish caught in the river, but also through the use of the river as drinking water and for other purposes. Once again, radiation doses varied significantly according to diet and distance from Hanford, among other factors. "Maximally exposed" individuals at Richland--that is, those who consumed a great deal of fish and drinking water from the river and who also spent a lot of recreation time around it--absorbed an estimated whole-body dose of 1,400 millirem between 1950 and 1971. Those who worked on the river (e.g. as ferry operators) are estimated to have received a dose about three times lower than the maximally exposed individual; typical residents of the Richland area, who ate little fish from the river, are estimated to have received doses ten-to-forty times lower than the maximally exposed person. Estimated doses for all points downstream from Richland would have been considerably lower, but it is worth noting that radiation emitted from Hanford made its way into shellfish along the salt water beaches near the mouth of the Columbia.

It is not a simple thing to put Hanford's radiation dosage figures into perspective. One way is to compare them to the doses of "background radiation" that people receive because radiation is a natural part of the environment. "A person in the

United States receives an average dose of about 300 millirem EDE [whole body dose] per year from natural radiation." One rad of dose to the thyroid is equal to about 33 millirem EDE.[63] Thus, the Ringold child maximally exposed to airborne iodine-131 received an estimated median thyroid dose of 235 rad, or 7755 millirem, between December 1944 and December 1951--about 3.7 times the amount of background radiation a person would have received over the same seven-year period. Study of the impact of such a dose on public health has not been completed; indeed, the impact of releases on specific individuals may never be known for certain. However, as the DOE conceded in 1990, it is widely believed that Hanford's radioactive releases increased the incidence of cancer and other diseases.[64]

While information about Hanford's radioactive emissions trickled out between 1986 and 1994, the Cold War context in which the releases had occurred remained a matter of some confusion and uncertainty. Some observers, commenting as if the Cold War was not taking place at the same time Hanford was spewing out radioactive wastes, have implied that the government should have fully disclosed Hanford's risks to the public, regardless of the cost to national security and of the tenor of the times. Others have insisted that Hanford had played a major role in winning the Cold War, and implied that the plant's emissions were a necessary, if regrettable, component of this geopolitical victory. Still others, rather amazingly, have written as if the Cold War had been a rather needless preoccupation of Americans,

and thus suggested that the whole issue of Hanford emissions somehow might have been avoided.[65]

The national and institutional context in which Hanford operated requires much more careful consideration than it has received. Historians are already reappraising the production and use of nuclear weapons in the Second World War and Cold War, but they give no sign of soon reaching any kind of consensus. In the meantime, established and popular ideas about the meaning of American nuclear weapons programs continue to color reactions to revelations about the release of radioactivity. Many neighbors and former neighbors of the site have long believed that their health, or that of their friends and relatives, had been imperiled by Hanford releases, and that the wartime context of the releases was not an adequate excuse for what the government had allowed to happen. Their claims have led not only to lawsuits against the DOE and former AEC contractors but also to federally funded investigations, such as the Hanford Thyroid Disease Study, devoted to scientific assessment of the health effects of Hanford emissions.

Litigation and scientific study have provided no rapid resolution of the questions surrounding the site, and as time passed criticism of Hanford continued unabated. The DOE may have hoped that "coming clean" would begin a process of reconciliation between Hanford and its critics, and it probably did, but the process moved slowly, and some of the resulting revelations merely fueled people's concerns about and animosity toward Hanford. Furthermore, while people expected that the litigation

would be contentious, they were perhaps unprepared for the realization that the scientific investigations would also be so controversial. Coming clean meant that Hanford had to continue to deal with extremely messy problems of public relations. (For example, even the size of its public relations budget received scrutiny and criticism.) Yet for the sake of restoring the agency's credibility, the DOE had to address public concerns directly.

Reactions to the DOE's releases of previously classified data, and to the preliminary results of studies of the effects of Hanford emissions, were striking. One refrain was wonderment at how the United States could have knowingly and silently poisoned its own people. That the government had done so earned for it comparison to the very enemies it had been intent upon defeating during the 1940s and 1950s. "It sounds like something done in Russia," exclaimed a farmer, born and raised downwind of Hanford emissions, whose family had been affected by thyroid diseases.[66] Critics of the nuclear establishment similarly pointed out that, in trying to defeat the Soviet Union through the development of nuclear weapons, the U.S. government had adopted some of the enemy's highly centralized and secretive ways.[67] (These critics gave little apparent recognition of the fact that the record of Soviet nuclear weapons programs, in releasing radioactivity, endangering public health, and failing to disclose information, was likely to be far worse than the American record.)[68]

Comparisons between the United States and the Soviet Union did not go over very well in the Tri-Cities, where the

psychological investment in a certain self-image and national reputation remained high. The communities near Hanford had never dealt kindly with critics of the nuclear establishment; accounts of the harrassment suffered by "whistle-blowers" in the area, for example, circulated throughout the decade. Some Tri-City residents complained bitterly of unfair "Hanford bashing" by outsiders, especially those located in western Washington.[69]

Amid the mounting criticism, many people at Hanford felt that their work over the years had not been properly appreciated or was now taken too much for granted. They liked to point out--using estimates of dubious veracity--that Hanford's production of plutonium had helped preserve at least a million lives by bringing World War Two to a quicker end, and saved millions more by maintaining the peace during the Cold War.[70] For defenders of the old Hanford, the struggle over the site's past meant highlighting Hanford's successes as a reaction against others trumpeting its failures. In this competition, both groups often resorted to hyperbole to make their point.

As defenders and critics of Hanford fought over the meaning of the past, the Tri-City communities began to come to terms gradually with the site's legacy. Consider the views of the Tri-City Herald, long the most persistent defender of Hanford in the region. Both shortly before and shortly after the DOE's initial release of 19,000 pages of documents, in February 1986, the Herald doubted that there had been "significant offsite environmental contamination or health hazards from releases of radioactivity over the years." This assertion was simply wrong,

and within weeks the Herald's editorial stance began to change dramatically. On March 19, 1986, the paper editorialized that "Hanford's early years of operation were dirtier than most of us imagined" and called for "a probing health study off the reservation." By October 1, 1986, the newspaper asserted that "there's no question any more that serious harm [to offsite populations] may have resulted from Hanford activities of the 1940s and 1950s."[71] As the months passed, the Hanford communities slowly began to reconcile themselves to the revelations of the late 1980s and early 1990s.[72]

Yet the tensions between those identified with Hanford and those on the outside did not wane. Continuing criticisms of Hanford's past provoked further claims from the Tri-Cities that the site's achievements were not adequately appreciated; widely publicized doubts about waste-management practices and the future of environmental restoration similarly made local people defensive. The rift between nuclear communities near Hanford and those outside, a rift which had widened throughout the 1980s, did not close during the early 1990s.

The tension between those communities close to Hanford and the outside world had at least two intriguing dimensions to it. First, the area's estrangement was in many ways a natural consequence of its great reliance on others for much of its livelihood. Hanford and the Tri-Cities had since World War Two depended greatly upon outsiders for their well-being. So long as the nation needed Hanford for military purposes during wartime and the post-war period, this dependence had not been a problem.

And even in the 1960s and 1970s, Hanford remained mostly in favor in such capitals as Washington, D.C., and Olympia, as well as on Wall Street where WPPSS raised money for building power reactors. When voters and politicians became less enamored of nuclear energy, however, the well-being of Hanford and the Tri-Cities was endangered. It was natural, then, to find fault with the outside interests which exerted so much power over the area's future--to accuse them, for example, of being uninformed about nuclear energy and insensitive to local needs and interests.

Second, it was also natural, in the face of adversity seemingly imposed from the outside, to stress unity and unanimity on the inside. Hanford and the Tri-Cities could not afford labor unrest during the early 1980s, the Tri-City Herald had warned, because it would jeopardize the economic future by scaring away prospective investors. Neither could the region (or its nuclear industry) afford division within its Congressional delegation, if it wanted to sustain federal support for the Northwest. With so many critics on the outside--critics of WPPSS projects, of waste-management practices, of past emissions, of DOE policies and priorities--it seemed crucial to many within the Tri-Cities and at Hanford that the local community maintain a consensus internally. The result, in part, was a host of Herald editorials asking for unity. These appeals, however, were not always realistic. It was not altogether reasonable, for example, to ask labor and management to avoid bitter disagreements, or to expect Pasco to share Richland's enthusiasm for bringing more of the nation's most dangerous radioactive waste to Hanford.[73] Neither

the communities of the Tri-Cities nor the citizens of the "outside" world were monolithic in their views.

Outsiders' criticism of the Tri-Cities was not limited to discussion of nuclear matters. The mid-Columbia communities, and especially Richland, had stood somewhat aloof from the rest of the state since the 1940s. The singular nature of the work at Hanford, and the unusual orientation away from Washington state toward the "other" Washington (D.C.), had created a somewhat isolated and unfamiliar enclave.[74] Until the 1980s, most people in the Evergeen State had welcomed the economic boost that Hanford provided, but they seldom got to know Hanford and the Tri-Cities very well. Some observers from other parts of the region likened the Tri-Cities to "nowhere" and stereotyped local residents as uniformly and uncritically pro-nuclear. A Spokane Spokesman-Review editorial of February 1985, for instance, lamented "the chilling flippancy [toward the nuclear industry] that prevails in Richland, where the high-school symbol is a mushroom cloud."[75]

But when hard times came to Hanford during the later 1980s, a few outsiders paid slightly closer attention to the mid-Columbia region, trying perhaps to understand why so many people remained attached to such seemingly troubled communities. They noted the comparative affluence of the region over the years, even for blue-collar workers, because of Hanford's presence.[76] One reporter also commented that, in the Tri-Cities, youths often welcomed the chance to work on the same site that had employed one or both of their parents. Many children were in no hurry to

leave the Tri-Cities. Clearly, although Hanford's booms had always attracted a somewhat transient population, since the late 1940s there had also been many Tri-City residents with a deep-seated attachment to community. Besides appreciating the relative prosperity, the inhabitants of towns near Hanford--including some refugees from big cities on the state's west side--felt attracted by the weather, recreational opportunities, sense of community, good schools, and absence of severe urban problems in the Tri-Cities area.[77]

In the 1940s, the mid-Columbia area had attracted the U.S. Army Corps of Engineers because it seemed remote and isolated enough that the Corps could build a secret plant there fairly safely. In the 1970s, promoters of nuclear power continued to tout Hanford's isolation from major population centers as a reason why nuclear power plants should be clustered together there in a nuclear park.[78] However, over the decades that the area's isolation was promoted as a virtue for nuclear development, two somewhat contradictory things happened that modified the meaning of the place in significant ways. First, a major population center--the Tri-Cities--emerged adjacent to Hanford, effectively ending the kind of remoteness it had once known. Second, the inhabitants of the area--despite their residence in a significant urban center--continued to see the region's "isolation" as an asset. By 1990 they appreciated the Tri-Cities' remoteness not so much any more because it encouraged development of more nuclear power plants, but rather because it

distanced them from the various problems associated with life in larger cities.

Despite the criticisms and cutbacks faced by the communities during the 1980s, there remained a solid and growing core of residents who remained deeply committed to the Tri-City area. The DOE's decision to invest a great deal of time and money in environmental restoration of the Hanford site assured these citizens of the permanence of a federal Hanford enclave and also buoyed the economy of their communities.

Pasco, Kennewick, and Richland, while affected in similar ways by outsiders' criticisms and by the ongoing changes at Hanford, in many respects continued to go in their own directions. For example, the three towns, but especially Pasco and Kennewick, voted against a 1985 proposal to merge together into the state's fourth largest city. Each community retained a distinct personality. While Richland was regarded as the "Gold Coast" of the Tri-Cities and "a bedroom for the reservation's scientific and managerial elite," and Kennewick was viewed as "a sprawling shopping area and bedroom for Hanford's blue collar work force," Pasco remained smaller, poorer, and more diverse.[79]

By the time of the 1990 census Pasco contained less than half the population of Kennewick, and earned less than half the per-capita income of Richland (see Table Seven). More than 40 percent of its population was Hispanic, and about 5.6 percent was African American. Pasco was the only one of the Tri-Cities with double-digit unemployment; about a third of its population lived in households with annual incomes below the poverty line.

Table Seven:[80]
1990 Census Data for the Tri-Cities

	Kennewick	Pasco	Richland
Population	42,155	20,070	32,315
African Americans	476	1,126	461
(% of population)	1.1%	5.6%	1.4%
Hispanics	3,684	8,277	983
(% of population)	8.7%	41.2%	3.0%
Percent Unemployed	7.0%	11.5%	5.1%
Per Capita Income (1989 dollars)	$12,767	$8,016	$17,085
Percent of population w/ income below poverty line	13.9%	33.0%	7.8%
Ratio of owner-occupied to renter-occupied housing units	1.13	0.90	1.65

Although some of its residents worked at Hanford, Pasco was least touched by the site's prosperity. The town was also least sympathetic to further nuclear development. In July of 1986 the Pasco City Council passed a resolution against the proposed importation of additional wastes to Hanford, saying that the idea "has placed an economic cloud on this area of irreparable and disastrous proportions" by threatening the agricultural and transportation-oriented economy upon which Pasco depended more than Kennewick and Richland.[81]

Kennewick continued to grow more quickly than its neighbors. While Richland lost more than 1,000 residents and Pasco gained only about 2,000 residents during the 1980s, Kennewick gained almost 8,000 residents, an increase of almost 23 percent. Many of the newcomers to Kennewick, as to Pasco, were Hispanics; by 1990 they comprised 8.7 percent of Kennewick's population. Apart

from being the largest of the three cities, in almost every other measure of affluence or diversity, Kennewick ranked between Richland and Pasco--but virtually always stood closer to Richland than to Pasco. Kennewick resembled Richland more than Pasco in large part because its economy, like Richland's, was much more dependent upon the fortunes of Hanford.

As the town closest to the nuclear reservation, and as headquarters for the DOE and its main contractors, Richland continued as the most prosperous of the Tri-Cities (and was now also the least diversified in its population). Richland's identification with Hanford thus remained very strong, but even that orientation slowly began to change. In 1985 one journalist had noted that the town wore "its atomic heart on its sleeve...Both the city and the Chamber of Commerce logos include depictions of the atom." Then in 1990 the Richland City Council sponsored a contest to develop a new city logo to replace the old one because "city officials felt a new image is needed in light of the thrust to diversify the economy and reduce the emphasis on Richland's ties to Hanford." The winning design, of course, dropped the atom, yet still conveyed a futuristic image with which the town wished to remain identified. A stylized portrayal of the sun, river, and mountains, it was perhaps meant to remind people not only of the local natural amenities but also of larger aspirations to clean up the Hanford environs.[82] To promote itself in the 1990s, Richland saw no reason to highlight its attachment to the nuclear industry. The atom now seemed a part

of a partially discredited past, rather than an ingredient on the technological frontier.

By the mid-1980s, the Tri-Cities Nuclear Industrial Council had similarly refashioned itself. In 1979, in the wake of the incident at Three-Mile Island, Sam Volpentest of TCNIC had recoiled at the suggestion that the boosters' group eliminate the word "Nuclear" from its title: "Hell no....We're not going drop it. We're stubborn. We've got nothing to fear from nuclear energy." By early 1985, however, the group had renamed itself the Tri-Cities Industrial Development Council, deleting the word "nuclear" in order not to scare prospective businesses away. Sam Volpentest, yielding to what seemed to be inevitable, conceded that "the emphasis has to change" in the local economy.[83]

As the region set about recruiting new kinds of commerce and industry (for example, by inducing retirees to move to the area) and getting used to Hanford's clean-up orientation, it became clear that an era begun with the Manhattan Project was drawing to a close. Many lamented the transformation, perhaps in part because Hanford's future was not soon likely to be tied up in mobilizing to meet such a national crisis as war. If, however, the psychological rewards of association with the site had been reduced, it was impossible to overlook the return of prosperity to the urban area during the early 1990s. In 1992, as employment at the nuclear reservation reached an all-time high, the cost of housing in the Tri-Cities increased faster than any other place in the country--a sure indication that another boom had arrived.[84] And contrary to the boom stimulated by the Manhattan

Project fifty years earlier, which had held out no certain future, this new expansion, based on a clean-up plan of thirty years, promised Hanford perhaps its longest sustained period yet of steady employment.

While there was still a lot of important work to be done at Hanford, its mission had changed significantly, as had the nature of the surrounding communities. The mission of 1993 was not at all what residents and leaders of the Tri-Cities had believed it would be through most of the 1970s and the 1980s. Efforts to acquire new reactors and to continue operating old ones had generally not succeeded. Similarly, attempts to diversify the Tri-City economy had met with only limited success. Hanford's prosperity remained largely dependent upon federal expenditures, albeit for clean-up now instead of for plutonium production.

In the current period of expansion, Hanford's mode of dealing with its neighbors and the public differed considerably from how it had operated during earlier booms. In the 1940s and 1950s, du Pont and General Electric, the contractors in charge at Hanford, prepared monthly reports for the government. These reports had two primary traits. First, they emphasized the matter of the site's productivity above all else, since Hanford's job was to generate as much plutonium as possible. Second, the reports were classified, so that nearby residents and the public never knew the details of what took place on the reservation. Even today, much of the information contained in the monthly reports, and in other key documents, remains classified.

In the 1990s, while monthly reports about Hanford continue to be produced, they are of a vastly different character. They comprise part of an enormous and expensive effort to inform the public about studies of the effects of past Hanford operations on health and the environment, and to include the public in decisions about the future of the Hanford site as the DOE and its contractors set about the job of environmental restoration. In the 1940s and 1950s it had been the job of the Army Corps of Engineers and the Atomic Energy Commission to keep the public uninformed about Hanford. In the 1990s it was the job of the Department of Energy to keep the public relatively well-informed about Hanford. This history, one supposes, is a part of that current effort.

* * *

For the half-century from 1943 to 1993, one constant for Hanford and the Tri-Cities has been the Columbia River. The Columbia was a crucial factor in the decision to build a plutonium-producing facility in south-central Washington in the first place. And, as the new city logo of Richland suggested, it remained an important ingredient in the identity of people living in the Tri-Cities. Examining changing attitudes toward the river can help one place into context the changing attitudes toward Hanford and technology in the mid-Columbia region.

By their nature, rivers evoke powerful meanings from the cultures that come into contact with them. However, each culture finds its own special meanings in rivers, and often its understanding will conflict with those of other cultures.

Furthermore, the images and ideas that a river evokes for one culture will change over time.

The Columbia meant many things to the Indians who dwelled in eastern Washington. With the arrival of non-Indians, new meanings were assigned to the body of water, and native uses of the river were challenged. Anglo-American society concerned itself increasingly with finding ways to extract wealth and power out of the river, and its efforts culminated in the development of the Columbia Basin Project. During and after the 1930s, the federal government implemented this program primarily by building dams for the purpose of generating hydroelectric power, irrigating farmland, controlling floods, and extending inland navigation. By using industrial technology to "tame" the river, the Columbia Basin Project promised to bring civilization and prosperity to the inland Northwest.

The presence of dams on the river, and of the hydroelectric power that they generated, permitted during World War Two the development of a second major federal project along the Columbia. At Hanford, the river became an integral component of another modern technology--plutonium production. Its waters served to cool the initial eight plutonium-producing reactors as well as to dilute and carry away the site's radioactive wastes. As long as the Hanford production reactors continued to operate, they required that the adjacent stretch of the river, the Hanford Reach, not be dammed, as had most of the river upstream and downstream. So the river continued to run unimpeded past Hanford, but even in this free-flowing state the Columbia

nonetheless remained a part of the Hanford industrial plant. And American culture understood that Hanford, like the Columbia Basin Project, contributed important things to the society. Its production of plutonium for nuclear weapons helped strengthen national security during both shooting wars and the cold war. And when Hanford focused more on energy production during the 1970s, proponents made claims about nuclear power's prospective contributions to society that resembled earlier claims made for hydroelectric power produced by dams on the Columbia.

In the later 1980s, the uses of the Hanford Reach of the river were re-examined, and so were its meanings to the broader culture. With the shutdown of all the plutonium-producing reactors, the Columbia was no longer part of the site's nuclear technology. Furthermore, the nuclear power park envisioned at Hanford in the 1960s and 1970s had failed to materialize. Therefore, local boosters could no longer in good faith oppose other uses of the Hanford Reach as an impediment to the development of a civilian nuclear economy. What, then, would become of the river adjacent to the reservation?

The fate of the Hanford Reach was revisited in response to a proposal to dredge that section of the river in order to permit barge traffic upstream to Wenatchee. In 1988 Congress rejected the dredging proposal and barred further development for eight years while the National Park Service studied how to manage the stretch of river. Four years later the Park Service recommended that the Hanford Reach be designated a "federal wild-and-scenic river" managed by the U.S. Fish and Wildlife Service, and also

argued for an 86,000-acre national wildlife refuge abutting the river's northern and eastern banks. (Ironically, this recommendation echoed the 1972 proposal of the Columbia River Conservation League, which the AEC and TCNIC had then opposed). According to the Park Service report, the Hanford Reach deserved special attention because it "looks the same now as it would have appeared a century ago. It is one of the last wild landscapes along the Columbia River."[85]

In the later 1980s, the agency that had proposed dredging the Hanford Reach was the Army Corps of Engineers, the very organization responsible for siting and building Grand Coulee Dam during the 1930s and the Hanford Engineer Works during the Second World War. And in the 1990s, even though prospects for further industrial engineering along the mid-Columbia seemed extremely unlikely, the Corps had more than dredging in mind for the Hanford Reach. As spokesperson Noel Gilbrough explained, "We are in the business of building projects. And that's the last major dam site left on the river. However, we are having a little trouble selling that dam."[86]

The Corps had trouble "selling that dam" because by the later 1980s and early 1990s American civilization no longer held the same attitudes toward technology and the environment that it had held during the first two-thirds of the twentieth century. Most people did not wish any more to add another dam to the Columbia Basin Project, or another reactor to the Hanford site. In fact, in light of the harm done by dams to fisheries along the Columbia, for example, or apparently done by radioactive releases

from Hanford to nearby biological communities, there had emerged among Americans a sense that previous attempts to industrialize and militarize the Columbia River had been somewhat shortsighted, and even a little arrogant in their confidence in the blessings that industrial technology could wring from nature. By no means did Americans wish to give up the kinds of prosperity and security that large building projects such as Grand Coulee and Hanford had provided over the years. But in the 1980s and 1990s, it increasingly seemed like a good idea to leave the Columbia River--or at least the brief stretch known as the Hanford Reach--alone.

NOTES TO CHAPTER SIX

1. Floyd D. Robbins, "Atomic Energy--A Reality for the Pacific Northwest," The Trend in Engineering, (College of Engineering, University of Washington) 14 (Oct. 1962):29; TCH, April 22, 1965.

2. Chet Holifield, "Remarks...at Richland, Washington, Respecting Hanford and Its Possible Future Development," April 23, 1970, RDF 6:7, pp. 2-3. See also Edward Bauser, "Remarks by Captain Edward Bauser at the Annual Meeting of the Tri-City Nuclear Industrial Council at Pasco, Washington," Jan. 15, 1975, RDF 11:2, pp. 6.
AEC officials at Hanford assumed as early as 1965 that new nuclear power plants would produce as many as 30 million kilowatts of electricity (out of the Pacific Northwest's projected total of 71.5 million kilowatts) by the year 2000. See TCH, April 15, 1965, clipping in "Hanford Works" file, Eells Northwest Room, Penrose Library, Whitman College, Walla Walla, Washington.

3. "Remarks by U.S. Senator Henry M. Jackson at an Appreciation Luncheon given for him by the Tri-City Nuclear Industrial Council (Verbatim from Transcript)," October 24, 1972, RDF 6:1, pp. 1.

4. "Remarks by Senator Jackson," 9-10, 7.

5. TCH, Oct. 25, 1970; Glenn C. Lee to Dixy Lee Ray, December 26, 1973, RDF 6:10.

6. TCH, Sept. 17, 1963. On the expectations for eastern Washington surrounding Grand Coulee Dam, see Robert E. Ficken, "Grand Coulee and Hanford: The Atomic Bomb and the Development of the Columbia River," Aug. 1993, revised version of paper delivered at Atomic West Conference, Seattle, Sept. 1992.

7. "Richland--Hanford Nuclear Park Newsclippings--4/70 to 1/71" file, RDF 6:6; quotations from TCH, July 13, 3, 1969. The AEC seemed to share the Tri-City Herald's response to the electoral defeat of nuclear power in Eugene. See G.J. Keto to John A. Erlewine, June 9, 1970, RDF 6:6.

8. TCH, Oct. 25, 1970.

9. See, for example, TCH editorials of March 4, July 6, 1970, October 17, 1975, April 20, 1976.

10. Glenn C. Lee to Dixy Lee Ray, April 25, 1974, RDF 6:10; Bauser, "Remarks," 1-2; R.F. Philip to James R. Schlesinger, Nov. 10, 1971, RDF 4:6.

11. Philip to Schlesinger, Nov. 10, 1971; TCH, March 17, 22, 1970. The idea of a "nuclear park" was apparently broached in 1963 by Owen Hurd of WPPSS, and endorsed quickly by TCNIC and the Tri-City Herald. See Christian Calmeyer Fleischer, "The Tri-City Nuclear Industrial Council and the Economic Diversification of the Tri-Cities, Washington, 1963-1974" (M.A. thesis, Washington State University, 1974), 126; TCH, December 15, 1964.

12. John C. Ryan to F.B. Michaels, March 18, 1965, RDF; Glenn T. Seaborg, "Large-Scale Alchemy--25th Anniversary at Hanford-Richland," AEC press release, June 7, 1968, FCP, pp. 11-12.

13. Leonard F. Perkins, "Remarks before the Pacific Northwest Cable TV Association," Richland, WA, Sept. 28, 1970, RDF, 10; Robert J. Hart, "Introduction to the Hanford Project," talk delivered April 23, 1970, to Seattle Industrial Council, RDF 6:7; Leonard F. Perkins to John A. Erlewine, September 9, 1970, "Draft Memo," RDF 6:2; D.G. Williams to L.F. Perkins, "Description of Land Utilization Maps," September 24, 1970, RDF 6:2; [Leonard F.] Perkins, "Nuclear Park Concept--Hanford Project," draft MS, Feb. 22, 1971, RDF 6:10, pp. 10, 1; D.G. Williams to John A. Erlewine, April 7, 1970, TS of telegram included in G.J. Keto to F.P. Baranowski et al., April 29, 1970, RDF 6:7.

14. National Academy of Public Administration, "The Institutional Aspects of the Energy Centers Concept," March 1977, (National Technical Information Service ANE-3086-1, for ERDA Contract No. Ex-76-C-16-3086), MS in FCP, pp. 3-18; J.K. Soldat, "Potential Radiological Impact of a Conceptual Hanford Nuclear Energy Center," Health Physics, 37 (Nov. 1979):828-29. Note that by the late 1970s the term "energy center" was used along with "nuclear park."

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16. Columbia River Conservation League, "Proposal for the Hanford National Recreation Area," 1-4.

17. R.F. Philip to James R. Schlesinger, Aug. 21, 1972, RDF 3:6.

18. Philip to Schlesinger, Sept. 12, 1972, RDF 3:6; Glenn C. Lee to Schlesinger, August 31, 1972, RDF 3:6.

19. G.J. Keto to Mike McCormack, May 15, 1973, copy, RDF 3:6.

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Dec. 31, 1973, RDF 5:5; F.P. Baranowski to J.L. Liverman, Jan. 24, 1974, RDF 5:5; Keto to John C. Ryan, February 19, 1974, RDF 6:1; Keto to Alex F. Fremling, May 29, 1974, RDF 3:6.

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33. USBC, United States Census of Population: 1980, Volume 1, Characteristics of the Population, Chapter C, Part 49, Washington, 23, 140-41. On shopping patterns, see TCH, July 31, 1969.

34. TCH, Jan. 1, 1982.

35. An editorial in the TCH, June 6, 1982, summarized the revised forecasts of future energy needs. Rather than growing at 7.5% annually, as previously estimated, the demand for new electricity would grow at a rate of 1% to 2% per year.

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39. See Daniel Pope, "Anti-Nuclear Activism in the Pacific Northwest: WPPSS and its Enemies," paper delivered at Atomic West conference, Seattle, Sept. 1992.

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52. NYT, Dec. 25, 1987; Sharon Begley with Patricia King, "This Land Is Really Hot," Time (Feb. 8, 1993):71.

53. Schumacher, "Weathering the Storm," 26-27; TCH, Oct. 5, 1987.

54. Eliot Marshall, "Hanford's Radioactive Tumbleweed," Science, 236 (June 26, 1987):1616; Fox cited in ST, February 4, 1990; White cited in P-I, July 16, 1985.

55. This shift in DOE policy is depicted in D'Antonio, Atomic Harvest, ch. 10. See also ST, February 4, 1990, August 23, 1992.

56. Michele Stenehjem Gerber, On the Home Front: The Cold War Legacy of the Hanford Nuclear Site (Lincoln, Neb., 1992). 210-11.

57. On DOE motivations in signing clean-up agreements, see the comments of John Tuck, undersecretary of the DOE during the Bush administration, in Danver Post, March 1, 1994. A thorough

look at the shortcomings of the Hanford clean-up process is the five-part series "Wasteland," SSR, Nov. 13-17, 1994.

58. On the complexities of clean-up and the problems of delays and costs, see Bill Dietrich, "Hanford mop-up: complex, costly," ST, June 1, 1992. On the threatened loss of jobs, see ST, August 23, 1992. In November of 1993, William Reilly, former head of the Environmental Protection Agency, criticized the yearly expenditure of about $1 billion on clean-up at Hanford because appropriate technologies for coping with the most contaminated areas of the Site did not yet exist. ST, Nov. 1, 1993.

59. TCH, October 2, 1993.

60. The writings of Michele Stenehjem Gerber--On the Home Front; Legend and Legacy: Fifty Years of Defense Production at the Hanford Site (Richland, WA, 1992); and "Historical Commentary: Historical Truth and Rebirth at the Hanford Nuclear Reservation," Columbia, The Magazine of Northwest History, 4 (Winter 1990-91):2-3--epitomize this sentiment. The TCH editorial was cited in ST, February 4, 1990.

61. On the 1990 DOE admission--anticipating a preliminary report by the Hanford Environmental Dose Reconstruction Project--see NYT, July 12, 1990. Gerber, On the Home Front; Jim Thomas, "Atomic Deception: Oh, What a Tangled Web!" Hanford Education Action League, Perspective 10-11 (Summer/Fall 1992):4-7, 17, 20; and D'Antonio, Atomic Harvest, 271-280, summarize some of the data and the resulting criticisms of the AEC and DOE. The "Green Run" was apparently an experiment conducted in conjunction with the U.S. Air Force that involved tracking radioactivity after it had been emitted from Hanford's processing plant. It entailed the release of 11,000 curies of radiation into the Columbia River Valley. Unexpectedly poor weather apparently resulted in less dispersal of the radioactive clouds than had been intended. A similar experiment was run at Oak Ridge, using Hanford fuel. See SSR, Dec. 18, 1994.

62. Information from this and the following two paragraphs concerning radiation doses comes from Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Summary: Radiation Dose Estimates from Hanford Radioactive Material Releases to the Air and the Columbia River (n.p., April 21, 1994).

63. Technical Steering Panel of the Hanford Environmental Dose Reconstruction Project, Representative Hanford Radiation Dose Estimates, Draft (Olympia, WA, 1994), 1.

64. "Most radiation protection scientists assume (even though the evidence is equivocal) that any dose, however small, carries with it a commensurate risk of cancer, with the

subsequent risk of cancer being directly proportional to the dose incurred." Ronald L. Kathren to Bruce Hevly, personal communication, June 1, 1994.

65. D'Antonio, Atomic Harvest, esp. 4-7, goes to the greatest lengths to suggest that the Cold War was simply mistaken and that Americans did not truly "win" the confrontation. This view is wholly ahistorical, and out of keeping in what is otherwise a fairly thoughtful study.

66. Tom Bailie cited in NYT, July 12, 1990.

67. See, for example, Ed Marston, "The West's nuclear Mandarins have reaped what they sowed," High Country News 24 (November 2, 1992):15. This line of thought is developed more fully in regards to the space race in Walter A. McDougall, ...the Heavens and the Earth: A Political History of the Space Age (New York, 1985).

68. See, for example, "Ural Villagers Live Nuclear Nightmare," ST, Jan. 31, 1995.

69. P-I, July 16, 1985; Williams, "Decline of the Nuclear Family," 70.

70. McDermott, "Atomic City," 12; W.K. Alexander, letter to editor, TCH, Oct. 10, 1986. See also the article headlined "Hanford veterans want a little respect," P-I, Oct. 8, 1990.

71. TCH, Feb. 28, March 19, Oct. 1, 1986.

72. Gerber, On the Home Front, ch. 8, offers one explanation of how the Tri-Cities adjusted to the various revelations by going through a kind of collective process of grieving. This interpretation (also hinted at by a ST story of August 4, 1988, headlined "The 'grieving' Tri-Cities have not lost all hope"), which sounds rather like pop psychology, begs the question of whether diverse communities of many people can experience events in the same way that single individuals experience grief.

73. See TCH editorials, for example, of August 22, Nov. 16, 1980, Jan. 11, April 5, May 21,1981, July 25, 1982, on unity, and article of October 21, 1986 on Pasco's opposition to further study of Hanford as a national nuclear waste repository.

74. It is worth noting that TRNIC hired a consultant and lobbyist in Washington, D.C., beginning in 1983, but the organization (renamed TRIDEC) did not get around to hiring its first contract lobbyist in Olympia until 1987. See TCH, March 7, 1987.

75. McDermott, "Atomic City," 10; SSR editorial cited by TCH, March 4, 1985.

76. McDermott, "Atomic City," 14; ST, August 4, 1988.
The high-tech production culture centered on Hanford resembled in many ways the entrenched timber cultures of the Pacific Northwest, where generations of loggers undertook dangerous work which they felt was unappreciated by outsiders, and which they wished to pass on, anyway, to their children. William Dietrich, The Final Forest: The Battle for the Last Great Trees of the Pacific Northwest (New York, 1992).

77. Williams, "Decline of the Nuclear Family," 36-37, 71.

78. TCH, April 29, 1979.

79. P-I, July 16, 1985; Schumacher, "Weathering the Storm," 21.

80. USBC, 1990 Census of Population: General Population Characteristics, Urbanized Areas (Washington, D.C., 1992), 18; 214; USBC, 1990 Census of Population and Housing: Summary Social, Economic, and Housing Characteristics, Washington (Washington, D.C., 1992), 52, 54, 81, 83, 84, 85, 128, 130.

81. Schumacher, "Weathering the Storm," 21.

82. McDermott, "Atomic City," 12; TCH, Nov. 16, 1990, Jan. 14, 1991.

83. P-I, Sept. 13, 1979; TCH, February 12, March 20, 31, 1985; ST, Oct. 22, 1989.

84. ST, February 3, 1992.

85. NYT, May 3, 1989; ST, July 2, 1992. Cf. National Park Service, Pacific Northwest Regional Office, The Hanford Reach of the Columbia River: Comprehensive River Conservation Study and Environmental Impact Statement, Draft (Seattle, June 1992).
Incidentally, Congressman Sid Morrison had in late 1987 introduced a bill supporting study of the Hanford Reach for possible inclusion in the nation's system of wild and scenic rivers. TCH, Nov. 6, 1987.

86. ST, July 2, 1992.