On the Home Front

The Cold War Legacy of the Hanford Nuclear Site

Michele Stenehjem Gerber

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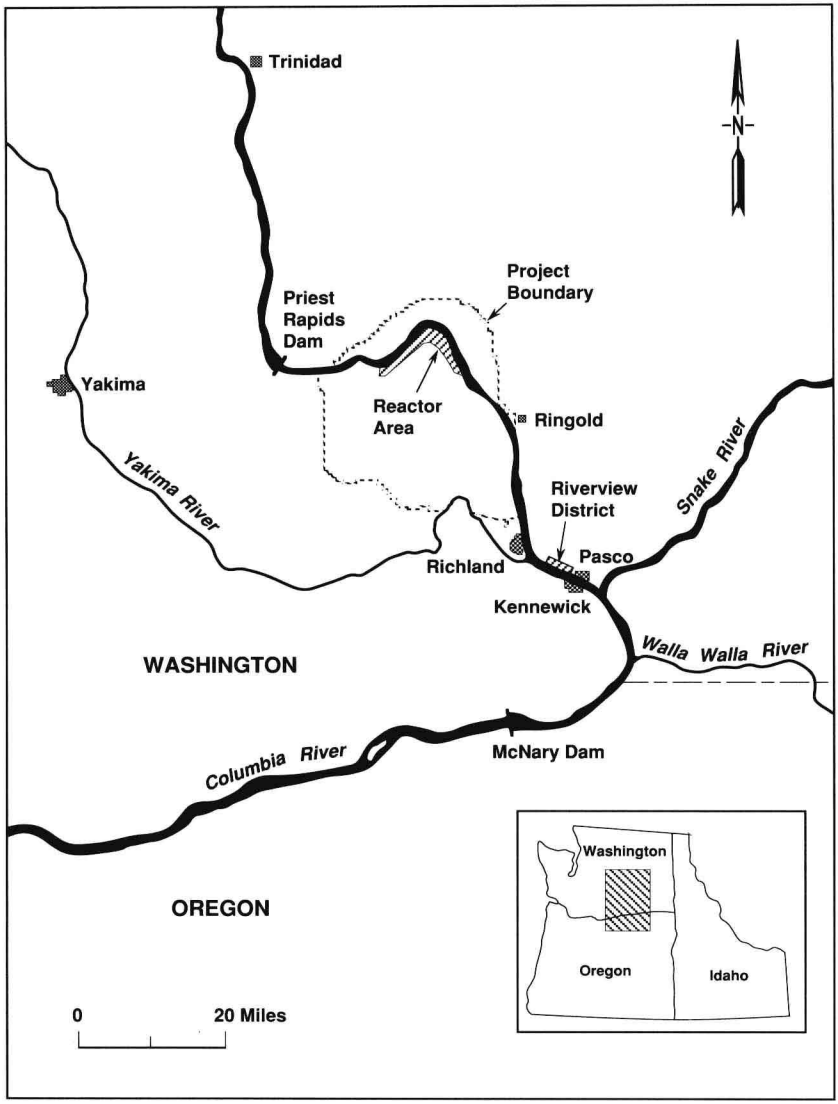

The Hanford Plant vicinity

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"completely controlled area" from which the public should be excluded, they decided, should exist for a distance one one-hundredth of the square root of the operating kilowatt level of each reactor. Applying this formula at Hanford, the "controlled area" would extend for a five-mile radius around each reactor. Outside of this control area, the committee asserted, that there was a "region of real but much smaller hazard." The group stated, "It seems to us reasonable that this area be inhabited, but we recommend that it not contain any large center of population." The group would not set a "definite radius" for this tract. However, it stated in secret, "We estimate that this 'hazard area' extends far enough to include the city of Spokane." The ACRS added: "Thought should be given to further safeguards [for the reactors]. By this we do not mean mere duplication or pyramiding of safety devices, but rather . . . safeguards operated on somewhat different principles and designed for new purposes . . . the potential usefulness of [the Hanford] piles depends in great measure on further safety devices."[144]

This report remained classified for twenty-six years. In 1949, in another secret document, Herbert Parker elucidated for top Hanford managers more about the 1948 ACRS findings. A reactor meltdown, caused by a total water loss, explosion, or enemy bombing or sabotage, he estimated, would create a triangle of air and ground contamination one to two miles wide at its base at the reactors. It would extend thirty to eighty miles outward at an angle "determined by wind direction." The inhabitants of this zone, Parker affirmed, would be "potentially killed by the inhalation hazard, unless previously evacuated."[145]

By 1955, eight reactors lined the Columbia River on the Hanford Site, and all operated at significantly elevated power and exposure levels. These levels continued to rise throughout the remainder of the decade.[146] Still, no metal shells or other safety domes existed to contain fission products in case of a severe reactor accident. This situation continued to worry the ACRS. Meeting in 1955, this committee recommended a series of experiments to determine the "rate of release of fission products from melted fuel elements" in case of a reactor accident at Hanford.[147] Tests in heating unclad uranium fuel rods at varying temperatures and irradiation levels were conducted from mid-1958 through 1961. During these tests, uranium oxide particles, and the radioisotopes of several gases such as xenon, iodine, ruthenium, tellurium, zirconium, and barium, were released in moderate amounts.[148]

By January 1958, the safety questions posed by potential explosions or meltdowns of the Hanford reactors had become the subject of intense debate within the AEC in Washington, D.C. At that time, the ACRS concluded: "In allowing the Hanford reactors to operate at present or increased power levels the AEC is

accepting a degree of risk which is greater than in any other existing plant. The Committee . . . [recommends] against increase in power or exposure levels until additional measures are taken to restrain the spread of fission products if they should escape from the reactor in an accident."[149] The ACRS wanted a completely "air-tight container . . . enclosing the entire reactor plant . . . the final safety device in protection of the environment."[150] On receipt of the ACRS recommendations, the commission's Director of Production, Edward J. Bloch, placed a temporary moratorium on planned augmentations in power and exposure levels at Hanford. GE engineers, however, argued for removal of these limitations, "even though the [limits] . . . did not jeopardize the production forecast previously provided to the DOD." They explained, "Whereas the *severity* of a reactor accident would be enhanced incrementally with each increase in power and exposure levels, the *probability* of accident would not be increased." Bloch concurred. In mid-1958, he recommended the removal of "current restrictions" in the Hanford reactors. He noted, "The contribution to national security through gains in plutonium production . . . appear to out weigh the . . . consequences . . . [of] the unlikely event of a major reactor accident."[151]

Throughout the remainder of 1958, the AEC debated Bloch's report and advice. At the same time, $4 million worth of filters and fog sprays were installed as interim safety measures in Hanford's reactors. A feasibility study completed that year showed that $40 million would be needed to "completely encase" the reactor buildings in metal shells.[152] In early 1959, the AEC approved the accretion of power and exposure levels at Hanford. Some commissioners disagreed, asserting, "In providing a completely safe situation, there should be no consideration of funds involved."[153] In early 1960, GE proposed further increases in maximum permissible power levels at Hanford. At that time, ACRS Chairman Leslie Silverman warned in secret, "The advisibility of continuing to raise Hanford power levels . . . remains as questionable as it did . . . several years ago."[154] Nevertheless, power accretions went forward. In 1964, the AEC admitted: "Dependence [at Hanford] was placed on strict administrative control of operations and the engineered safety features of the reactors to prevent . . . a major release of radioactivity . . . Studies showed that containment domes similar to those on power reactors could be built but would be extremely costly."[155] None of the eight reactors operating at Hanford at the time were ever encased in a protective dome.

Airborne Waste and Army and Company Security Forces at Hanford

During the years of Hanford's heaviest airborne emissions, one group with high potential exposure was the army and company security force that guarded

the site. These sentries, especially those patrolling the complex and constructing and manning the antiaircraft defenses, were near the atmospheric wastes and the contaminated sand and vegetation. They slept out overnight on the atomic reservation, often in open-air tents or hastily built huts and barracks. While the construction dust swirled from 1943 through 1955, while tests of various particulate and gas filters went forward throughout the late 1940s and 1950s, while the 1950–51 experiments with shortened metal cooling times were conducted, and while the radioruthenium flakes whirled from 1952 to 1954, they walked, stood, dug, ate, and slept on the contaminated site.

A small force of Military Police (MPs) and Military Intelligence (army G-2) personnel guarded the Hanford Site at the start-up of plutonium manufacturing in late 1944. In June 1945, the MP allotment was increased to forty soldiers. Their chief role was to patrol the miles of fences, roads, shoreline, and river of the Hanford Site. Additionally, the Bonneville Power Authority (BPA), a federal entity, provided a few patrolmen of its own to protect the Midway electrical substation and power transmission lines. The substation was located near Vernita, approximately seven miles west of B reactor. Because of this proximity, Matthias stated that the army would "accept no responsibility" for the safety of these guards.[156] Army MPs remained at Hanford until April 1947, when the new AEC assigned guard duties to company patrolmen of the site contractor, GE.[157] However, the huge production expansion initiated in late 1947 brought new concerns about security. In early 1948, General Mark Clark, commander of the Sixth Army (Western Defense), asserted, "Troops should be there [Hanford] permanently—and immediately."[158] In both the spring and the fall of that year, Clark sent troops from Fort Lewis (near Tacoma) to the atomic complex on prolonged maneuvers. However, according to Senator Henry M. Jackson, the congestion and lack of housing in the 1947–49 expansion prevented the troops from staying permanently.[159] In the meantime, GE's security patrols were issued M-8 light armored tanks.[160] Although this equipment was useful for ground actions, the antiaircraft defense crucial to Hanford was still missing.

Finally, in March 1950, in the biggest convoy in Washington State's history, troops arrived at the Hanford Site from Fort Lewis. They brought 120-mm antiaircraft guns, each protected by four 50-mm machine guns. Their headquarters and temporary housing was at North Richland. In 1951, "Camp Hanford" was officially designated by the army. Eventually, three battalions, the 501st, 518th, and 519th, served at the station. In late 1952, the antiaircraft guns were replaced by Nike missiles. These in turn were supplanted by more advanced Nike Ajax missiles in 1954. Still later, Nike Hercules missiles, bigger and faster

weapons with a nuclear option, were emplaced. The 1st and 83rd missile battalions, along with support services groups, served at Camp Hanford during the Nike years. By the late 1950s, however, the development of intercontinental ballistic missiles had rendered Hanford's missiles obsolete. On July 1, 1959, Camp Hanford became a subpost of Fort Lewis. The Camp was deactivated in 1960, and the North Richland offices were transferred to the AEC in 1961.[161]

Very little written material about Camp Hanford has been preserved by the army.[162] The one booklet that is available, and the statements of several veterans, attest to the rugged, outdoor life of the troops who staffed the gun and missile emplacements. Furthermore, the same sources reveal that the troops were not given special radiation equipment, information, training, protective clothing, nor warnings of potential or real hazards.[163] Many of the MPs and Camp Hanford soldiers have similar memories of life outdoors on the atomic site. One MP has recalled his service during 1946, the year that 76,000 curies of I-131 swirled out from the plant's stacks. The main MP base was located between Richland and the production areas. He has recounted: "We lived and ate there except when we were at the sub-station which had Quonset huts where we slept and a separate one . . . [where] we ate. We had almost daily duty at some sentry position. There were the Richland, Yakima and Prosser barricades, the substation, the desert patrols, the airport and motor pool, and camp sentry duties . . . I do not recall any . . . radiation training . . . Clothing was regular Army issue . . . We did not have any radiation dosimeters, film badges or geiger counters . . . We were never told that we were subject to any radiation exposure."[164]

In addition to the main base at North Richland, Camp Hanford maintained sixteen weapons emplacements around the production areas. Three of these bunkers were across the Columbia River, on the Wahluke Slope. This region was very prone to gaseous drift and deposition from the Hanford plant stacks. Veterans of the original army detachment that came in the spring of 1950 have recounted that when they arrived at Hanford, the army told them nothing of their mission or of the nature of the Hanford plants. The young men were driven in open vehicles across the sandy, unpaved roads of the Hanford Site and deposited about two miles west of the 200-W Area. There were no facilities. The sagebrush had been bulldozed away shortly before the troops arrived, and the former soldiers remember that the sandstorms were terrible. The men were told to build gun emplacements and to fill hundreds of sandbags around them. For about two and one-half months, they were picked up each evening and driven back to North Richland to sleep. After that time, they moved into tents near the gun bunkers. They did calisthenics in the sand each morning and were

required to stay out of their tents, near the guns, all day. They got three days' leave every fifteen days. On this leave, they were restricted to the Tri-Cities area, and they generally slept in the North Richland barracks. They also received thirty days of furlough per year, when they were free to leave the region. They watched the excavation and early construction of the REDOX plant and lived amid the billowing dust of that project. In 1951, with no explanation, they were ordered to move their entire position about four miles to the west. Once again, the sagebrush was bulldozed and they dug their camp and gun emplacements in the sand. They wore regular army clothing and had no radiation equipment, dosimeters, nor information.

Veterans of the later, missile years at Camp Hanford have told of similar conditions. However, as the years went on, more of the roads were paved on the Hanford Site, and the forward missile bases got concrete buildings with tile floors, windows, and running water. Also, the missiles were stored underground, so that soldiers were not required to fill and emplace as many sandbags. Some of the demolition troops spent their time dynamiting sections of the White Bluffs to stabilize crumbling overhangs and to provide rock for construction crews on the Hanford Site. None can recall receiving any special radiation training, clothing, equipment, or information. According to one veteran: "I was never told anything in particular about the Atomic Plant. I understood that it produced parts and/or materials for atomic bombs and that was about it . . . Upon my discharge, I had to sign a form . . . that I would never tell anyone what I knew about the Atomic Plant. I thought that was funny because I didn't know anything about it!"[165]

Although some people worried about the silent and invisible risks in the air, sand, and desert vegetation at Hanford, no steps were taken to warn or protect the soldiers. A GE engineer assigned to design filters to trap the radioactive particulates spewing from the 200-Area ductwork and fans between 1946 and 1950 recalled later that he was especially worried about the guards who circled the canyon buildings about one thousand yards out. "I suggested that [Hanford officials] reveal to everybody what the situation was, and have them wear respirators; my group wore them . . . But they didn't tell anybody . . . The reason was alarm."[166] As Camp Hanford itself was created and enlarged in 1950–51, AEC officials in Washington, D.C., and in Richland secretly discussed possible dangers to military personnel. Early in the camp's history, AEC-Hanford Manager David F. Shaw recommended to the ACBM that soldiers spend no more than one-third of their time in plant areas. The troops should be "exposed to airborne particles to the same or lesser degree as plant personnel." However, he stated in early 1951 that the new silver reactor filters in the

separations plant stacks had reduced the external radiation dose to a "negligible" level. Current emission levels, he told the AEC, "should not be a limiting factor in the military personnel duty."[167] At nearly the same time, Herbert Parker's H.I Division established three new air-monitoring stations "to evaluate the dosage to which military personnel" were exposed. Radioactivity values at these locations, H.I. staffers reported in June, "were among the higher dosage rates outside of the operating areas."[168]

Environmental-monitoring surveys conducted over the ensuing years of the 1950s continued to demonstrate airborne radiation levels that were higher at Camp Hanford's forward positions than at off-project or 300-Area locations. In fact, readings at some of the military sites often were comparable to measurements within five miles of the 200 Area.[169] During the 1954 radioruthenium particulate releases from REDOX, Parker told Shaw, "The appropriate control of military forces within the [Hanford] reservation introduces special problems." A month later, evaluating the external (beta burn) radiation hazards from the particles, Parker again flagged the exposure risks of the soldiers. "The military personnel on the site appear to be at greatest risk."[170] On at least three occasions between 1956 and 1958, army positions on the Hanford Site, especially those at Rattlesnake Mountain, demonstrated the highest radiation readings of all locations at the atomic complex.[171] Yet, the monitoring data and internal GE communications were classified, and the troops were never informed.

Airborne Wastes and the Columbia Basin Irrigation Project

Growers of the Columbia Basin Irrigation Project came to the Hanford region beginning in 1948. Their outdoor occupations and the fact that they disturbed and worked amid the contaminated vegetation and sand, as well as their position to the east of the atomic site ("downwind"), may have placed them at augmented risk. Additionally, many farm families drank milk from backyard cows and ate leafy produce from backyard gardens. Both of these diet factors increased the amounts of radioactivity that were ingested. If a family's life-style also included hunting and fishing, quantities of radioactivity rose still further.

The CBP was a long-postponed dream by the time World War II began. The idea for a huge dam at the Columbia River's Grand Coulee, about 120 miles north of Pasco, had been proposed as early as 1892. The concept of building a dam at the head of this huge, empty flood channel and running irrigation water down it to bring life to the parched soils of eastern Washington came to life in the Rivers and Harbors Act of 1935. Water began to fill the partially completed reservoir (Lake Roosevelt) behind the dam in 1939. The first priority of the project, the generation of electrical power, commenced in October 1941. Ameri-

can entry into World War II two months later drained manpower and money from the irrigation aspects of the Grand Coulee enterprise. During the years of battle, only preliminary reclamation surveys and engineering studies could be done.[172]

The main portions of the CBP actually developed between 1946 and 1960. Progress was not uniform. Budget constraints, the huge Columbia River flood of 1948, and the ongoing postwar operations of the Hanford project intervened. Nevertheless, in a phased, albeit somewhat spotty fashion, new farms crept southward from the Grand Coulee to Pasco. There were two notable exceptions. Block I, about fifty-four hundred acres just north of Pasco, was the first to be occupied and tilled in May 1948. Conversely, the Wahluke Slope, a huge area just north of the Columbia River from the Hanford Site, was withdrawn from the CBP when the atomic complex was established. In early 1947, the U.S. Department of the Interior, Bureau of Reclamation (BOR), reported to the AEC a "prospective increase in per acre construction costs on the remainder of the project . . . and an added burden for operation of the rest of the project." However, "by far the most serious loss," according to the BOR, was the "blocking of agricultural production valued at . . . $22.5-million, based on 1946 farm prices."[173]

The land and the favorable credit terms of the CBP were popular. The decision was made to allocate farm plots on a lottery basis, with preferences given to World War II veterans. Additionally, farming experience and cash assets were firm requirements. Still, callers abounded.[174] Many of the hopeful young veterans submitted their names year after year to be matched with a piece of the flat, dry Columbia Basin. By the end of 1958, water was available on nearly four hundred thousand acres of CBP land. In about 1960, with demand for land still strong but declining slightly, the veteran preference was dropped.[175]

The CBP was divided into three major segments: the Quincy, East, and South districts. The South District, extending roughly fifty miles north from Pasco, was the one closest to the Hanford Site. This district also included the Wahluke Slope. With the exception of Block I near Pasco, the Quincy and East districts developed sooner than the South District. Intense construction activity and overcrowding in the Pasco area (due to postwar Hanford expansions) and uncertainties over the availability of Wahluke land caused delays in the southern CBP sector. In the Quincy and East districts, encompassing major chunks of Grant and Adams counties, construction activity, land values, and town growth leaped between 1948 and 1955. From 1954 to 1959, the farm blocks on the east side of the Columbia River, just across from Hanford, filled with families.[176]

The Wahluke Slope issue continued to vex the CBP. In July 1948, the AEC announced its decision to permanently restrict farming in a "central zone" of about 88,000 acres (45,000 irrigable) on the slope. It also set aside "secondary zones" on either side of the central sector, where irrigation was "indefinitely deferred." The secondary zones consisted of approximately 173,000 acres, of which 107,000 were irrigable. "Security needs and possible dangers to inhabitants" were the reasons given by the AEC.[177] In fact, the upsloping Wahluke terrain caused concentrated quantities of 200-Area off-gases to come to ground there. The furtive sheep, cattle, jackrabbit, and wildfowl thyroid checks of 1946–47, as well as the secret, ongoing air and vegetation monitoring by Hanford scientists, had shown very heavy wind drift and contamination along the slope. One such survey in February 1947 found at least twenty-seven spots on Wahluke land where vegetation contamination exceeded Herbert Parker's "tolerable concentration" of 0.2 μCi/kg.[178] Furthermore, when the AEC's Reactor Safeguards Committee evaluated the risks of Hanford's operations in 1948, its classified report affirmed: "The main hazards to prospective residents of Wahluke Slope is the violent increase in pile activity leading to fire and dispersal of fission products and plutonium through the countryside. For a person just across the river from the pile the danger would indeed be most acute." With regard to the 200-Area stack emissions, the committee asserted: "The distribution of these stack materials over the Wahluke Slope and over many other areas to great distances is a cause of much concern. Their elimination is essential."[179] In December 1948, the AEC reaffirmed its decision to close the slope to farming and stated that it was "highly improbable" that these lands could be opened for settlement "within the foreseeable future."[180] In 1953, the AEC did grant right-of-way acreage on the Wahluke Slope for certain roads, canals, and power lines of the CBP.[181]

The issue of opening Wahluke Slope lands to agriculture and settlement was raised again in 1958 as the ACRS was evaluating the question of increasing power and exposure levels in Hanford's reactors. GE scientists reported to the ACRS: "in the absence of gross accidents . . . the general contamination of the Wahluke Slope is comparable with that of the Tri-City area . . . Restriction of the occupancy of the Slope against normal contamination is thus not plausible." In the case of a reactor meltdown or explosion, however, they stated that a "release of reactor contents" might "exercise its effect mainly over the Wahluke Slope."[182] As the AEC discussed the power level throughout the remainder of 1958, the question of settlement at Wahluke Slope was raised over and over.[183] In December 1958, when the AEC decided to allow the increase of reactor power and exposure levels at Hanford, it also agreed to release the secondary zones of

the Wahluke Slope to the BOR for farm development. Additionally, about thirty-two thousand acres in the control zone were transferred to the custody of the bureau, but no agriculture was permitted.[184]

The first farm blocks on the Wahluke Slope were occupied in 1961 and 1963. In mid-1965, the AEC announced its intention to release approximately thirty-nine thousand acres of the control zone to the BOR for "daylight farming" (nonresidential) only. However, drainage studies completed by the bureau in 1967 demonstrated that irrigation there would contribute to underground pressures that could increase the potential for landslides toward the White Bluffs and the Columbia River. They decided not to develop the land.[185] In November 1971, the AEC issued permits to the U.S. Fish and Wildlife Service and to the Washington State Department of Wildlife to divide the control zone into two wildlife refuges. The western portion became the federal Saddle Mountain National Wildlife Refuge and the eastern (larger) portion became the state Wahluke Wildlife Recreation Area.[186]

Aside from the Wahluke Slope, settlement of the CBP's South District did go forward between 1953 and 1958. The farm families who came to live across from the Hanford plant in Franklin County and southern Adams County, along with the 1948 settlers of Block I near Pasco, struggled hard with the dusty Columbia Basin. In the mid-1950s, a Washington State College survey of CBP families found that family labor, including labor by wives and children, typified the lives of CBP settlers.[187] All CBP settlers, whether they came in 1948 or a decade later, remember the dust and wind. Settlers who bought farms in the region in the mid-1950s quipped that a person could "sneeze and create a dust storm."[188] A 1957 newcomer spoke for others by stating simply, "Our land was powder."[189] Leo Vogel, who wrote a book about his late 1950s farm settlement in Franklin County, described the Columbia Basin ground: "Even the heavier soils will blow with a little encouragement, and the lighter soils are treacherous indeed . . . Wetting down the soil does little good. As soon as the top layer of molecules gets dry the wind will lift it and send it on its way." The year 1959, he recalled, was an especially windy one.[190]

As CBP farms were platted, surveyors "staked" the fields. Every one hundred feet, they placed a stake marked "cut" or "fill" a certain depth (usually one to four feet). Surface irrigation demanded level land. Next, "levelers" came in huge tractors dragging scrapers behind them. Throughout the 1950s and early 1960s, BOR tractors had open cabs. One driver recalled, "You ate a lot of dirt." Leveling went on all year long, unless the ground was frozen. Next, dirt irrigation ditches two to three feet deep were dug on each farm. "Corrugates," three to twelve inches deep, were cut through the fields perpendicular to the

ditches. One mid-1950s farmwife has stated, "Maintaining the ditches and corrugates, keeping them clear of weeds, kept you outside all the time, kept you lean." In the 1960s, cement ditches came to the CBP. In 1976, most of the land was re-leveled for push-button "circle" (sprinkler) irrigation.[191]

As the CBP was filling the counties north and east of Hanford with families, site scientists studied and discussed hazards connected with farm settlement. In the late 1940s, they worried especially about the development of Block I because the irrigation water for that tract was drawn directly from the Columbia River about twenty miles downstream from 100-F Reactor.[192] Crop tests in 1949 showed radioactivity values in soil two miles north of the old Hanford townsite to be "higher by a factor of ten than the average given for non-irrigated land on the east bank of the Columbia." During the 1950 growing season, levels of beta radioactivity in the crops and soil of the test station increased by 25 percent over the length of the season. Still, Hanford scientists termed the amounts "only minor," adding that "none was significantly high to cause concern."[193]

Over the ensuing years, many crop studies were undertaken at Hanford. The susceptibility to, and uptake rates of, radioactivity in various plants were determined. In 1950, Hanford researchers found that tomato plants grown in sand through which reactor effluent had been passed concentrated the radioactivity three to ten times over the level of the sand. In the following two years, Herbert Parker's H.I. Division tested the translocation of yttrium, and radioisotopes of cesium (Cs-137), strontium (Sr-90), and cobalt (Co-60) in barley, wheat, and red kidney bean plants. Again, they found higher concentrations in the plants themselves than in the activated nutrient solutions. In one experiment, vegetables and meat were boiled in water containing reactor effluent; as the liquid evaporated, the uptake of radionuclides in the vegetables was "greatly accelerated." Absorption of radioactivity by the meat also occurred, but at a lesser level.[194] The results of these experiments were usually classified and were not shared with BOR officials nor with the Columbia Basin farmers. For reasons of economy, the bureau did not conduct its own tests for radioactive contamination in the vegetation, soil, or water. Also, the bureau did not believe that it had sufficient expertise in radiological science. It accepted the AEC's assurances of radiological safety.

During the heaviest radioruthenium particulate emissions of 1954, growers working the wheat harvest were not informed of any problems, even when Herbert Parker calculated dose rates of 700 mr/hr, every six hundred feet, in the farming areas of Benton and Franklin counties. Even though, according to Parker, "ground contamination was found in orchard and field crop areas,"