nuclear's wastelands part 2 – hanford, the nuclear frontier

In the second of a series of articles on the local and social legacies of nuclear energy, Andrew Blowers looks at the history of nuclear activity at the Hanford site in the Pacific Northwest of the United States

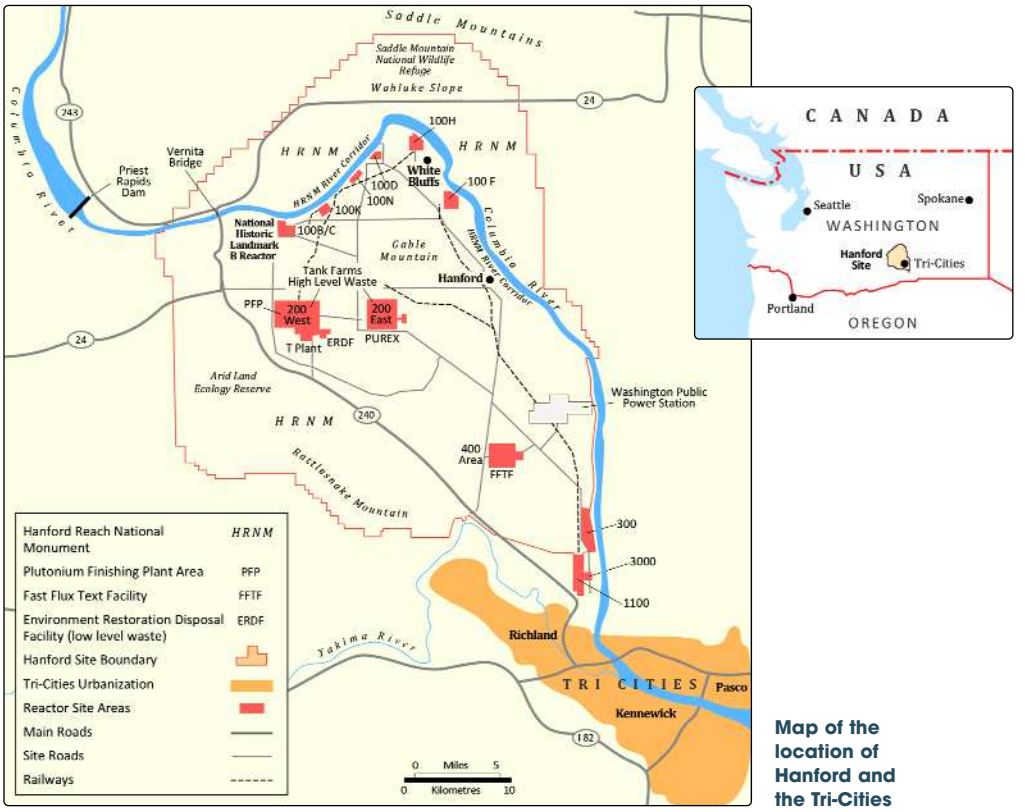
Cynthia C Kelly, Courtesy of the Atomic Heritage Foundation, USA

Abandoned farm at pre-war Hanford

Up in the Pacific Northwest of the United States in eastern Washington state the mighty Columbia River bends east, then south before turning west for its long journey to the Pacific Ocean. In this middle reach the river passes through a landscape that has been utterly transformed by the nuclear industry over the past three-quarters of a century. For it was here in December 1942 that Lieutenant Franklin T Matthias, flying over the area on a mission for the Manhattan Project, exclaimed: 'This is it!' He commented later that 'the site was so good that there couldn't be a better one in the country. It looked perfect in every respect.'[1]

It was big country, with few people, and above all isolated – just the place for the secret, war-driven purpose of making plutonium, the deadly fissionable material that, less than three years later, would be used to explode over the skies above Nagasaki. Hanford, in the American West, a frontier land where the Lewis and Clark expedition had passed in 1805, had become, a century and a half later, the American nuclear frontier, the Atomic West.[2] This semi-desert region of bare and barren brown and yellow hills and plains of sagebrush interspersed with homesteads of settlers and homelands of Native Americans was transformed into a landscape of risk and ultimately a nuclear wasteland, 'the little-known reservation that is arguably the most polluted place in the western world'.[3]

Hanford is one of the US Department of Energy's nuclear military reservations, places which have combined to produce the American nuclear arsenal.



John Hunt

Map of the location of Hanford and the Tri-Cities

It is one of the three oldest and key wartime sites, along with Oak Ridge, Tennessee, and Los Alamos, New Mexico. Like them, it has the classic characteristics of a 'peripheral community',[4] but over the years, as its mission has changed and its economy has developed and diversified, it has become less isolated and more integrated into the mainstream – evidence of the dynamic nature of peripheral characteristics. Nevertheless, Hanford remains, to an extent, a place apart, defined by its history and ongoing nuclear activity, which, in a somewhat perverse way, provides a stability and sustainability that will endure for decades to come. Hanford is a long-established nuclear wasteland that has reached a level of maturity and permanency which illuminates the persistence of nuclear in the era of nuclear's decline. Hanford's history, perhaps, also indicates nuclear's future.

'Peace! Our bomb clinched it!'

It is difficult now to imagine the frenetic activity and scale of the mobilisation of technology, science and human resources that brought about the transformation of Hanford in the wartime years. In these extraordinary circumstances homesteaders were evicted, responding with a passive acceptance of the exigency of war mingled with resentment at the loss of livelihood. Native Americans were banned from fishing and gathering in the area of the Hanford Reach. All that now remains of the pre-war settlements is an abandoned farm warehouse and a crumbling bank and high school marking the site of the tiny settlements of White Bluffs and Hanford.

The Hanford site covers 586 square miles (larger than Bedfordshire and half the size of Rhode Island). The outlying parts of the reservation have been left as wilderness – the protected areas of the Wahluke Slope to the north, the Hanford Reach of the Columbia River, and the Arid Land Ecology Reserve flanking the bare saddleback Rattlesnake Mountain to the west. As Roy Gephart, who has chronicled the nuclear landscape, puts it: 'It contains a portion of

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'Our bomb clinched it!'

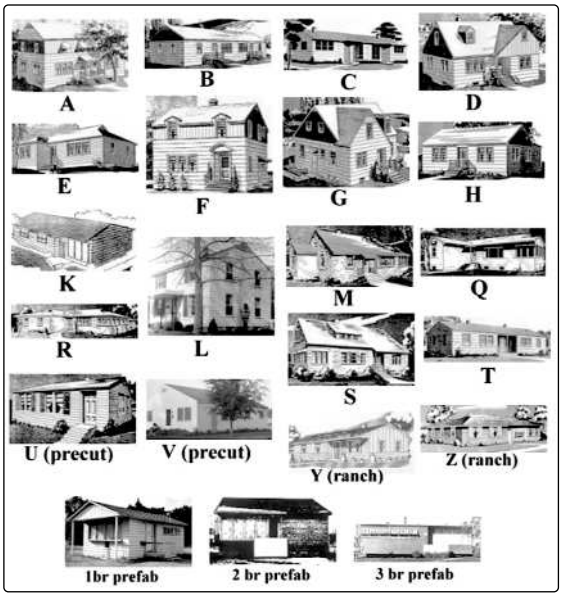
the nation's most dangerous waste while preserving some of the most unique desert ecology within the Pacific Northwest.'[5]

Within these precious and pristine surrounds lies the heart of Hanford. In those frantic few wartime years, Hanford became the largest construction site ever assembled in the USA, with at its peak in 1944 50,000 workers recruited from across the nation and housed in barrack-like segregated accommodation with communal facilities. In these primitive conditions in a harsh climate they fashioned an incredible nuclear complex. They built reactors (then known as 'piles') along the Columbia to produce spent fuel for chemical processing, in long and massive plants called 'canyons' which turned out the small amount of plutonium (13.6 pounds, the size of a softball) assembled in the 'Fat Boy' Nagasaki bomb.

The Hanford workers had no idea what they were producing until it was revealed that 'It's atomic bombs' on the morrow of the devastating impact on Nagasaki. The revelation was met with a surge of patriotic pride in Hanford's winning the war. As Michelle Gerber, Hanford's historian, commented to me in 2004, 'Nothing can make you that proud ever again.'

Production and pollution

During the ensuing decades of the Cold War, Hanford was at the heart of the United States' military nuclear production. Along the Columbia a further fleet of reactors was built, and inland, at the centre of the site in the so-called '200 area', giant reprocessing and finishing plants took over from the wartime 'canyons' dedicated to the production of plutonium. Elsewhere, as well as hosting these facilities Hanford became the scene of a variety of non-military experimental facilities, such as the Fast Flux Test Facility breeder reactor. On the Columbia River is the Columbia Generating Station, a public nuclear power plant supplying electricity, the only survivor of a grandiose plan for five nuclear power stations in Washington state which failed in the face of financial overreach and environmental opposition.[6]



Columbia River Exhibition

'ABC' housing types used in the development of Richland

Expansion of production was accompanied by rapid urban development as the temporary settlements of wartime Hanford were replaced in the post-war period, and the population settled in towns just to the south of the reservation. Foremost of these was Richland, a veritable company town built and controlled by the government. In its spacious layout and social purpose it had echoes of Garden City and new town principles, as well as the integrated neighbourhood unit concept of Clarence Perry.[7] Indeed, in its early years Richland conveyed an egalitarian community ethos, regulated and communal, while also expressing hierarchical values in the so-called alphabet ('ABC') housing of varying size and rent designated for different groups – 'upper echelons' (administrators scientists), mid level (managers, engineers), down to blue-collar smaller homes and single-sex dormitory blocks.

The sense of identity with history of this 'Atomic City' is expressed in such features as 'Bombing Range Road' and its identification as 'Home of the Bombers', with its mushroom cloud, the symbol of its high school football team. Remnants of the early days still survive, although since its incorporation in 1958 Richland, with Kennewick and Pasco, has formed the Tri-Cities, a modern small metropolis with a population of 54,000 in 1962, increasing to around 250,000 today.

With the area's almost single-minded focus on wartime and Cold War productive effort, the negative consequences were grossly neglected. By today's standards the treatment of wastes was casual, neglectful and irresponsible. Low-level liquid wastes were siphoned off into cribs and swamps, while an estimated 56 million gallons of highly active liquid wastes from reprocessing were pumped into 177 tanks (149 single shelled and 28 double shelled), some of which have been leaking for many years, posing a threat to groundwater moving to the Columbia. These tanks constitute the most intractable of Hanford's clean-up problems, requiring intense manipulation and management prior to vitrification – a solution which still seems a long way off.

According to one estimate, there are some 1,700 waste sites and 500 facilities to be decommissioned, most of them along the Columbia or on the central part of the site.[8] The inventory includes around 450 billion gallons of liquids discharged to the soil, 5 million cubic yards of contaminated soil, and 80 square miles of contaminated groundwater. The full extent of the contamination of this palpable nuclear wasteland is impossible to gauge with accuracy and, as Roy Gephart argues, 'deciphering this entire inventory is less important than

pinpointing, or at least bounding, those portions posing the greatest potential health risk'.[9]

For years the scale of the accumulating problem was unknown and unregarded. The operations at Hanford were shrouded in secrecy and cover-up as the site's overriding priority was to continue to respond to the country's defensive demands. There were myriad incidents and experiments, paying little heed to human health or environment.

The most serious was the notorious experimental 'Green Run' in 1949, when there was a deliberate release of radionuclides, including iodine-131, casting a plume of radioactivity stretching 200 by 40 miles east and south-west of Hanford and giving readings exceeding the contemporary exposure standards by hundreds of times in the downwind communities. The idea was to develop a monitoring methodology to enable the US to simulate Soviet bomb-making capacity.[10] According to historian Jerry Gough, whom I interviewed in 1999, 'The atrocity of the Green Run was not the release itself but the fact they didn't know what its effects might be. This was outrageous.'[11]

From plutonium culture to environmental culture

The outrages enacted on the Hanford landscape during the Second World War and the Cold War were concealed by a 'plutonium culture' – a combination of patriotism, belief in nuclear technology, and unquestioning trust in expertise that pervaded the communities in what Kate Brown has called *Plutopia*.[12] With the ending of the Cold War there emerged a gradual but ultimately decisive cultural transformation. There was a transitional period of a decade or so up to the early years of this century, during which, reluctantly at first but pragmatically, Hanford was coming to terms with its new role and relationship with the nuclear industry. Three key developments in the change can be perceived.

First, and most obvious, was that the ending of the Cold War signalled the end of production at Hanford. Indeed, production had been declining since its peak in the mid-1960s as the era of *détente* and arms limitation set in. It was the closure in 1987 of Hanford's N reactor (described by President Kennedy shortly before his assassination in 1963 as a project that 'symbolises our strength as a nation') that effectively brought Hanford's military role to an end. Thereafter, apart from some experimental and research facilities, Hanford ceased production altogether.

The second development was the shift from secrecy to greater openness, marked especially by the publication in 1986 by the then site manager, Mike Lawrence, of the records revealing the sheer scale of the legacy and the casual attitudes to risk that had prevailed. In an interview with me in 1999 he argued that 'what went on here was good and necessary' but that 'it was very secretive; we know best... How can people understand if they are not told?'

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Hanford's waste tanks, seen here under construction, constitute the area's most intractable clean-up problem

The end of production and the revelation of the legacy precipitated the third development, a fundamental change in Hanford's mission to a focus on environmental clean-up. The process is durable, unending and intractable, complex, and, in some ways, controversial. The key challenges are: removing high-level wastes from leaking tanks; decommissioning the reactors along the Columbia; and decontaminating and decommissioning the huge reprocessing canyons. Apart from these massive projects there are the myriad problems associated with redundant facilities, waste dumps and other hazards, including the perhaps impossible task of dealing with radioactive plumes beneath the site.

Some progress has been made, notably the removal of spent fuel and progressive cocooning of the redundant reactors in interim storage, engineering the secure storage of plutonium, decommissioning redundant facilities, and cleaning up contaminated sites. But the most difficult and costly challenge is the clean-up and remediation of the tanks and the vitrification of the high-level wastes in the Waste Treatment Plant (WTP), the construction of which has been plagued by delays, technical problems and cost escalation. The ultimate aim of cleaning up the Columbia Corridor and concentrating the most problematic and hazardous activities in an inner core of 10 square miles at the centre of the site seems some way off.

The management of the clean-up process has been criticised for its institutional inertia, reliance on big contractors with short-term contracts, changing strategies, and low productivity. Bill Dixon, an engineer with experience of working at Hanford, told me in 2013: 'The approach has been for the gold standard, which makes WTP expensive and long term.' Rather than an open-ended commitment, the US Department of Energy, the ultimate paymaster, presses for an accelerated programme based on a risk-based approach to make sure less money is spent in a shorter timescale for a lower standard of remediation.

In the end 'clean-up is a conditional, negotiated state',[13] and a collaborative approach called the Tri-

Party Agreement has been in force since 1998, involving the Department of Energy, the federal Environmental Protection Agency, and the state of Washington's Department of Ecology. This provides for a consensual approach on priorities, milestones, and actions. An element of public participation in clean-up is provided through the Hanford Advisory Board, with a broad stakeholder membership advising on major policy issues. Among the continuing controversies are questions such as: should all buildings be demolished; should all tank wastes be vitrified; should all reactors be moved to the central area; which areas should become available for unrestricted use – and when; and, the overarching question, how clean is clean enough? That question, given the uncertainties and different opinions, is a matter of both scientific and value judgement.

Stability and sustainability

Hanford has entered a mature and relatively stable stage in the relationship between its communities and the nuclear industry. The peripheral characteristics that were its *raison d'être* have evolved, and Hanford has undergone a profound change from isolation to integration – a community still marked by its nuclear history but no longer entirely defined by it.

Chosen for its remoteness to undertake a national strategic and secret operation, Hanford, although far from major centres, is far more accessible nowadays. The Tri-Cities is a fully connected and fast growing sub-regional centre. Its economic dependence on the nuclear industry, although still considerable, is much diminished. Fears of a steep post-production decline in the nuclear industry have been eased by the federal appropriation routinely provided to Hanford to the tune of $2 billion per year – around a third of the national nuclear clean-up budget. At the same time, the economy of the Tri-Cities has developed, with research laboratories (originally a spin-off from the nuclear activities) but also health services, food processing and wineries, high-tech industries, and regional retail and distribution services. Hanford's, or rather the Tri-Cities', economy is now neither dependent nor monocultural, but diversified and sustainable.

Hanford, created and supported by the state throughout its heyday, continues to exert political leverage. Politically speaking, Hanford is not just an environmental issue; it is a moral issue, which accounts for the obligation towards its clean-up mission felt by federal, state and local governments. There is still a residual sense of embattlement in a Republican pro-nuclear community within a Democratic state with pronounced anti-nuclear sentiments in the big cities to the west beyond the Cascade Corridor. But the mutual hostility of the years of nuclear production has abated, and mutual interest in clean-up has fructified. In short, a modernist discourse associated with the nuclear industry has shifted to a postmodern discourse of consensus and co-operation, reflecting the more complex economy and diverse society that constitutes the Tri-Cities area today.

United States Department of Energy

The cocooned Hanford F reactor, post-remediation

A continuing legacy

Hanford's is a landscape traumatised by its wartime and post-war existence at the heart of the American nuclear-industrial complex. In this vast area are the remnants of a plutonium economy that has left a polluted landscape which will persist down the generations. 'Hanford represents one of the most daunting environmental catastrophes the world has ever known',[14] comparable in scale and contamination to the contemporary Russian Cold War complex of Mayak near Chelyabinsk.[15] The problems arising from an ageing infrastructure are difficult to contain. Major recent incidents include the collapse of a rail tunnel storing waste from plutonium production, further incidents of tank leakage, and risks to workers from demolition work.

It is intended to release most of the land to non-nuclear purposes. Already much is protected or conserved, and the stretch of the Columbia that runs through the site is under conservation as the Hanford Reach National Monument, a wildlife, fishing and recreational area, with the historic reactors dotted along its southern bank. In 2015 some of the historic nuclear structures, including the B reactor, were incorporated in the Manhattan Project National Historic Park, along with similar features at Los Alamos, New Mexico and Oak Ridge, Tennessee, the other main wartime nuclear projects.

It will take time, resources and effort to achieve clean-up and to provide adequate, safe and secure interim storage for the Hanford wastes. The overall costs are estimated at over $100 billion, with a

AECOM

Clean-up operation on the Columbia River

deadline for clean-up of 2060 – both likely to be exceeded. The WIPP (Waste Isolation Pilot Plant) deep disposal facility in New Mexico, the destination for the military transuranic wastes buried at Hanford, has been suspended since 2014 owing to brine seepage. With the suspension of the national repository project at Yucca Mountain in 2008, a new process for finding a suitable site has begun. The slow progress with the vitrification plant and the lack of a national repository make a final solution for the disposal of vitrified high-level wastes a distant and uncertain prospect.

Hanford, the Atomic City of the West, was once at the nuclear frontier, creating weapons of devastating destructive power that left a nuclear wasteland. Today it is at the frontier of a massive clean-up project, described as 'the largest civil works project in world history'[16]. The nuclear pioneers engaged in the defence of the nation appropriated a landscape truly awesome in scale, a sparsely settled wilderness in the mid-Columbia plateau, and transformed it into a scattered industrial complex in the sagebrush desert. Their successors have been left with the legacy of those years – a task of retrieval, containment, remediation and improvement to restore the landscape where possible and to withdraw those parts which are irremediable.

For the foreseeable future Hanford will remain a nuclear wasteland, where risk from wastes not fully comprehended or characterised lurk on and beneath its surface with no final solution yet in sight. It is a place where the impacts from a frenzied period of destructive impulse will linger indefinitely; a place where, in the words often attributed to Native American Chief Seattle, it may truly be said: 'We do not inherit the earth from our ancestors, we borrow it from our children.'

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Notes

1 Quoted in J Findlay and B Hevly: *Atomic Frontier Days: Hanford and the American West.* University of Washington Press, 2011, pp. 18-19

2 B Hevly and J Findlay: *The Atomic West*. University of Washington Press, 1998

3 M D'Antonio: *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal*. Crown Publishers, 1993

4 The concept and characteristics of 'peripheral communities' were explored in the first article in this series (see A Blowers: 'Nuclear's wastelands. Part 1 – landscapes of the legacy of nuclear power'. *Town & Country Planning*, 2016, Vol. 85, Aug., 303-8). In brief the characteristics are: remoteness, marginality, powerlessness, cultural resignation and resilience, and environmental risk. It may be noted here that the characteristics are dynamic, responding to changing power relations. A more detailed analysis of the concepts of peripherality and peripheralisation will be found in A Blowers: *The Legacy of Nuclear Power*. Earthscan from Routledge, 2017

5 R Gephart: *Hanford, a Conversation about Nuclear Waste and Cleanup*. Battelle Press, 2003, p.v

6 The Washington Public Power Supply System (WPPSS) planned to build five large nuclear plants during the 1970s to serve Washington state. The project was a disaster, suffering cost overruns and delays, leading to one of the biggest defaults in history, with two stations never built, two halted during construction, and only one, that on the Hanford site, eventually completed. The scandal became popularised as WHOOPS!

7 C Perry: 'The neighborhood unit, a scheme of arrangement for the family-life community'. In *The Regional Survey of New York and its Environs*, 1929, Vol. 7, 22-140

8 An estimate prepared by United Kingdom Nirex Limited for my visit in 2004

9 *Hanford, a Conversation about Nuclear Waste and Cleanup* (see note 5), p.5.3

10 The Green Run was a release in December 1949 of radioactive iodine-131 from 'green' (less-cooled) uranium fuel, apparently to test instrumentation for detecting Soviet bomb-making capability. It was not revealed until the 1980s, becoming notorious for the harm it may have caused in downwind communities

11 For a downwinder account of the unknown threats from Hanford, see T Hein: *Atomic Farmgirl*. Mariner Books, 2003. She points out that the Green Run was only one of many deliberate and accidental post-war releases from the site. The Green Run released 8,000 curies in an estimated total of 740,000 during 1944-72 (p.xi)

12 K Brown: *Plutopia*. Oxford University Press, 2013

13 *Hanford, a Conversation about Nuclear Waste and Cleanup* (see note 5), p.8.6

14 S Shulman: *The Threat at Home: Confronting the Toxic Legacy of the US Military*. Beacon Press, 1992, p.94

15 D Bradley: *Behind the Nuclear Curtain: Radioactive Waste Management in the Former Soviet Union*. Battelle Press, 1998

16 G Zorpette: 'Hanford's nuclear wasteland'. *Scientific American*, 1996, Vol. 274 (5), 88-97