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Miriam Engler

Iowa State University, miraengl@iastate.edu

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Abstract

MARKED BY THE SCIENTIFIC DISCOVERY of atomic energy, the nuclear age, which spans the twentieth century, has changed the nature of culture as well as the landscape. 1 Vast, secret landscapes play host to nuclear arms and commercial energy producers. 2 Nuclear sites concern not only scientists and politicians, but also environmental designers/artists. The need to evoke a cultural discourse, protect future generations, reveal or conceal radioactive burial sites and recycle retired installations engenders our participation. How do we intersect with these hellish places? Do we have a potent role in addressing this conundrum? In what follows, I confront the consumption and design of today's most daunting places - the landscapes of nuclear material production, processing, testing and burial.

Keywords

Nuclear Culture, Nuclear Landscape, Post-nuclear monuments, Atomic museums, Post-nuclear gardens/wilderness, Nuclear waste

Disciplines

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Comments

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Post-nuclear Monuments, Museums, and Gardens*

MIRA ENGLER

INTRODUCTION

MARKED BY THE SCIENTIFIC DISCOVERY of atomic energy, the nuclear age, which spans the twentieth century, has changed the nature of culture as well as the landscape.¹ Vast, secret landscapes play host to nuclear arms and commercial energy producers.² Nuclear sites concern not only scientists and politicians, but also environmental designers/artists. The need to evoke a cultural discourse, protect future generations, reveal or conceal radioactive burial sites and recycle retired installations engenders our participation. How do we intersect with these hellish places? Do we have a potent role in addressing this conundrum? In what follows, I confront the consumption and design of today's most daunting places – the landscapes of nuclear material production, processing, testing and burial.

The first part of this essay examines the cultural phenomenon of “danger consumption” embodied in atomic museums and landmarks across the United States. The second part reviews the role of artists and designers in this paradoxical undertaking, particularly designers who mark the danger sites, making them publicly safe and accessible, or who fashion ‘atomic monuments’. The role of design and art is further examined using the submissions to the 2001 Bulletin of Atomic Scientists Plutonium Memorial Contest, which highlights a range of design approaches to creating a memorial to the world's storage of the lasting, glowing poison. A third section briefly examines the work of a group of photographers who bring images of these restricted areas to light. Finally, the essay's conclusion considers the designation of nature reserve in and around nuclear sites and the design of parks on decommissioned atomic reservations.

CONSUMING DANGER (OR ATOMIC TOURISM)

Cultural imaginings of atomic power are replete with extreme concepts – horror and beauty, fear and awe, triumph and tragedy, discovery and destructiveness, death and rebirth. These diametrically opposed pairs harbour extreme aesthetics and emotions previously reserved only for the gods. Nuclear places are endowed with similar power and aura. Many Nevada residents remember stopping and picnicking along Highway 95 to watch atomic test blasts. When detonations began at the Nevada Test Site in 1951, the Las Vegas Chamber of Commerce promoted the testing programme as a tourist attraction: “It provided maps and calendars detailing the best locations for viewing the blast” (Goin, 1991: 24). Cultural expressions of the new nuclear age have thrived in folklore. Atomic cab companies; atomic cafés and motels; atomic dances, drinks, and hairdos (hair

Mira Engler, Associate Professor of Landscape Architecture at Iowa State University, Ames, Iowa 50011, United States of America.
Email: miraengl@iastate.edu

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pulled over a wire form shaped like a mushroom cloud, then sprinkled with silver glitter); and even the bikini (owing its name to the Bikini Atoll nuclear test) sprouted across the United States in the 1950s. Many science fiction movies, novels, and cartoons dwelt and elaborated on the newly charged state of existence. But while most of these manifestations of interest lost their potency and faded over the decades, tourism became more vigorous.

Publicly accessible nuclear sites attracted tourists throughout the Cold War era, but the thaw in US–Soviet relations in the late 1980s only increased their popularity. Roadside America's *Traveler's Guide* (Kirby, Smith and Wilkins, 1992) prescribed a practical though cautious guidance of a seven-day tour through a dozen of the most recommended atomic plants, reservations, museums and test sites: a national circuit that stretches from Washington's Smithsonian Institute atomic exhibit, through the various 'birth places' and 'homes' of the atomic bomb to missile launch bases and to ground zero, the Trinity Site where the first bomb was exploded on 16 July 1945 (Kirby, Smith and Wilkins, 1992). The 1995 website of the Bureau of Atomic Tourism, an organisation dedicated to the promotion of atomic tourist locations around the world, was given a four-star rating by the *Seattle Times* and was recommended by *Entertainment Weekly* (Bureau of Atomic Tourism, 2001). The year 2000 witnessed another surge in public access when tours to a number of new sites began (Horowitz, 2000). Following 9/11, some military bases closed their grounds to the public, but the new urgency felt at the heightened threat (in the form of 'dirty bombs') only added another dimension to the emotional response of a more vulnerable and scared nation.

Atomic Monuments

Monumental in space, time and consequence, some nuclear landscapes are deservedly awarded National Historic Landmark status. No literature or conversation on the subject spares a comparison of these sites with the greatest monuments on Earth, the remnants of bygone cultures – the temples of the Aztecs, Maya, Greeks and Romans, and the burial sites of the Egyptians and Native Americans. The nuclear landmark thus serves to mark and prolong a collective memory of a defining cultural moment, making its claim on a historical rather than a moral ground.

There are about twenty atomic national historic landmarks in America. The most significant of them, the Trinity Site, represents not only the quick end to the war in the Pacific but also the threshold of the atomic age. Located in the desert valley of Jornada del Muerto – "Journey of Death" in Spanish – near Alamogordo, New Mexico, the site was declared a national historic landmark in 1975 and is opened to the public only twice a year. A modest lava stone obelisk marks the spot of the explosion. A number of other nuclear sites and laboratories were recognised throughout the 1980s; for example, Launch Complex 33 at the White Sands Missile Range in New Mexico, which features a 'missile park' with about 40 rockets and missiles, and Room 307 in Gilman Hall at the University of California, Berkeley, where the element plutonium was first identified.

One of the most important sites in the matrix of atomic places, the Nevada

Test Site, a 5,400-square-mile bombing range where more than 1,000 atmospheric and underground bomb explosions took place, serves as America's most potent icon of atomic landscapes. The site underwent thorough documentation work by a group of archaeologists from the Desert Research Institute in the late 1980s. Consequently, several places in the Nevada site associated with tests for peaceful civil uses, such as canal building, have secured their national register designation (Johnson and Beck, 1995). The Sedan Crater – an impressive concavity resulting from the 1962 Genome explosion, which relocated 12 million tons of earth and created a hole measuring 1,280 feet in diameter and 635 feet deep, and the remains of a simulated Japanese village bombed in the BREN operation in 1962 (an experiment to study the shielding characteristics of buildings) are likewise designated a National Register Property (Johnson, Goldenberg and Edwards, 1997). Since 2005, the Nevada site has become the focus of a nearby museum, the Nevada Atomic Testing Museum. The museum lays out the history of the nuclear tests, displays an “archaeological collection” from the site and organises tours to the test site.

Another Nevadan atomic bombing range named Bravo 20, near the town of Fallon, has received much attention following the photographer Richard Misrach's 1990 book of the same name. In this work, filled with lengthy accounts of victimised people and saturated with overtly anti-militaristic sentiments, Misrach furnishes a mesmerising photographic record of this surreal landscape and proposes turning Bravo 20 into America's First Environmental Memorial, a place that “would serve as a permanent reminder of how military, government, corporate and individual practices can harm the earth” (Misrach, 1990: 98). Yet, oddly enough, the spirit of the design seems to dwell on and magnify militarist consumer passion and tourist consumption. Misrach styles the visitor centre and museum after a typical military ammunition bunker and, with considerable design insensibility, ensures every possible ingredient that a Disneyland developer would have considered: a circular road, control towers, strafing targets, simulated ships, laser bulls'eyes, dummy bombs, a primitive camping area, a café with a blinking neon bomb on top and, of course, a gift shop.

Atomic Museums

The institutions that have traditionally served as a major conduit of information to the public – atomic museums (frequently called peace museums and often absorbed into science and energy museums) – are thriving. More than 30 nationally sponsored military, corporate and science museums that display the nuclear artefacts of army and industry are found on military bases, in the corporate headquarters of defence contractors, in national weapons laboratories, in municipal parks and at remote desert locations. Their declared mission is education. Intended to provide a record of recent military history and scientific invention, and to preserve the relics of atomic culture, they have been heavily criticised and accused of becoming mere instruments of propaganda for United States military policy and corporate power. The historian Peter Kirstein argues that they seem to create “psychic numbing” within the public and to contribute to greater acceptance of the ‘utility’

of atomic arsenals (Kirstein, 1989: 45). After examining a couple of dozen of these sites, Kirstein found that they unanimously celebrate the merely “advanced technological instruments” without portraying any sense of tragedy or “human damage”, and only rarely suggest the destructive potentialities and grave consequences of what they display. Most commentaries, he claims, are furthering the atomic-bomb-as-peacemaker thesis, the argument that the bomb prevented American (and Japanese) carnage during World War II and deterred Soviet Communist control of the world during the Cold War. They make no efforts to present alternative or revisionist interpretations (Kirstein, 1989: 47). Movie makers, instead, filled the gap. Erik Barnouw’s 1970 film *Hiroshima/Nagasaki August 1945*, brought to light the landscape and human scenes of the two bombed cities. Other films of the 1970s and 1980s, such as *The Day after Trinity* (1980) and *Radio Bikini*, followed.

SIGNIFYING DANGER (OR ATOMIC ICONS)

The power of artists and designers lies primarily in their verbal and visual tools of representation, which both reflect and shape public image and construct and deconstruct perceptions. Beginning at the turn of the twentieth century, writers in the new field of science journalism brought the discoveries and wonders of atomic radiation to the public, advancing its development. At the same time, humanists and artists have taken on the role of ethical guardians. In *Nuclear Fear: A History of Images*, Spencer Weart (1988) eloquently lays out the old, deep-rooted sources of universal imagery associated with atomic power and nuclear fission. Reviewing twentieth-century literary and art works, Weart posits that, until 1945, artists responding to discoveries about nuclear energy expressed the quest for traditional values and reasserted religious or humanist ethics. Following the bombing of Hiroshima and Nagasaki, writers addressed human responsibility in general (as William Golding (1954) did in *Lord of the Flies*); they avoided fastening the blame on the ‘mad scientist’, and still found human nature reparable (Weart, 1988: 408). In the 1960s and 1970s, poets and painters echoed the anti-nuclear movement’s rejection of scientific authority and dismally foretold catastrophe. Cataclysm, however, was always followed by a rebirth (Weart, 1988: 416). In the past 15 years, the role of cultural signification has been extended to include environmental designers undertaking previously unheard-of tasks, such as marking dangerous nuclear repositories.

Nuclear Mausoleums and Memorials

Nuclear dumpsites, none of which has landed a desirable position on the national register, but all of which have received much attention, have taken the tradition of shunting to new extremes of distance, depth and fortitude. The option of burying radioactive waste in rock formations several hundred feet below the Earth’s surface won out over such alternatives as blasting radioactive waste into the sun, injecting it into sediment below the deep ocean floor, and allowing the hot stuff to melt into Antarctica’s two-mile thick ice sheets (Breen, 1992: 55). Meanwhile, the several hundred temporary dumpsites nationwide, of which 150 are known to be severely contaminated, await proper treatment. The damage

being done to underground water supplies and rivers, to entire ecosystems, is irreversible. Some consider these hidden radioactive depositories to be slow-release bombs, active for as long as hundreds of thousands of years. Moreover, the money spent for environmental management of nuclear waste sites has surpassed the cost of weapons production in the Department of Energy's total budget, making it the agency's largest programme (Salvesen, 1994).

The long road to approved 'deep storage' took more than 50 years from the opening of the first temporary repository in Oak Ridge, Tennessee, in 1944. The Waste Isolation Pilot Plant site (WIPP) opened near Carlsbad, New Mexico, in 1999. Because that site was limited to trans-uranic wastes only, the hunt for a high-level waste disposal site continued; the sole location considered was Nevada's Yucca Mountain, which is scheduled to open in 2010. Its aridity and minimal erosion make the site suitable, but looming seismic activity remains a concern, and the compliance period devised by the Department of Energy to protect the environment is a subject of fierce dispute.

Another major concern is the possibility of human intrusion on the disposal site at some point in the future. Marking the site to inform potential intruders of its danger is a major task engaging scientists, engineers and environmental designers alike. Beginning in 1981, scientists turned to the past in order to learn what enables information to survive and then incorporated this knowledge in the design of a marking system. Archaeology came to the rescue (Kaplan and Adams, 1986: 51). The research performed by the Analytic Sciences Corporation for the United States Government Office of Nuclear Waste Isolation (ONWI) for the Hanford waste site in Washington responded to the 1982 draft regulation by the Environmental Protection Agency (EPA), which mandates that "the disposal system shall be identified by the most permanent markers and records practicable to indicate the danger of the wastes and their locations", and suggests an effective regulatory framework of 10,000 years (with only 100 years of active surveillance). Ancient monuments surviving two to five millennia were analysed for durability and marking systems: the pyramids in Giza, Stonehenge in England, the Acropolis of Athens, the Great Wall of China, the Nazca Lines in Peru and the Serpent Mound in Ohio. It was determined that written language is more effective in carrying meanings over time than are symbols and pictures, though a combination of the two could be productive. As for the survivability of languages over 10,000 years, the archaeologists were uncertain. Stone monoliths and pottery shards were proven as being more reliable than metals, which showed a tendency to be dismantled and recycled. The design for Hanford proposed standing stones at least twice human height and bearing two symbols, as well as text in the six languages of the United Nations and in the local Yak'ma Indians' native language. The text stated: "Danger. Radioactive waste. Do not dig here". Small, three-layered subsurface ceramic discs of eye-catching colours designed to withstand erosion, root growth or animal action were also incorporated (Kaplan and Adams, 1986). Ultimately, neither the waste repository, nor the markers were implemented.

For the permanent dump in New Mexico, the United States Department of Energy and the Sandia National Labs employed two teams composed of anthropologists, linguists, architects, material scientists, artists, astronomers and psychologists to come up with a design. “The Marker Project”, as it was dubbed, built on the previous work for Rockwell, but participants continued to debate the effectiveness of signs, languages and spatial structures. The architect Michael Brill introduced a design rooted in deeply held psychological archetypes, creating “landscapes of repulsion”, or spaces that project a sense of danger – a spike field; huge black basalt slabs; menacing, jagged earthworks; and forbidding rubbles. Others preferred to avoid anything too unusual that might provoke unwelcome curiosity (Strauss, 1992). The site will end up surrounded by a 33-foot-high berm marked with a series of 25-foot-high granite obelisks inscribed in seven languages, much like Hanford’s marker. Discs made of durable material are embedded inside the berm. Radar reflectors and magnets mark the site for satellite observation (Kastner, 1999). Tom Vanderbuilt (2001: 150) summed up this enigmatic task: “How can you build it so they won’t come?”.

The Plutonium Memorial Competition

Seeking solutions to the problem of plutonium disposal, in May 2001 the *Bulletin of the Atomic Scientists* called on artists, architects, and visionary thinkers to design a “Plutonium Memorial”.³ The premise behind the competition was that if we build a prominent ‘storage’ facility, possibly powered by the heat of radioactive decay, we would always know where the stuff was and “we would not have to worry about the human tendency to forget about burial grounds after two centuries”, writes Linda Rothstein, the *Bulletin’s* editor and the conceiver of the contest (Rothstein, 2001: 29).

The winning entry by Michael Simonian of San Francisco was titled *24110* (the precise measure in years, according to some scientists, of the half-life of plutonium-239); it located the memorial south of the White House in Washington, DC (as opposed to the Nevada Desert), and under a partly lifted, circular lawn ‘carpet’. A capillary layer of gravel and volcanic tuff covers the casks and a walkway is marked with ‘clock totems’, a would-be 241 flared steel tabs, one of which would be bolted to the ground every century to mark the passing of a little plutonium half-life. The siting turns upside down two sacred conceptions: the out-of-sight (and the backyard of the poor) and the great American lawn cover-up. It wittily states that sweeping the issue under the carpet is no longer an option.

Imagery and Ideation in the Plutonium Memorial Contest

A jury comprising an artist, an architect, a Nobel Prize laureate, a board member of the *Bulletin* and the *Bulletin’s* editor reviewed the 150 entries from 20 countries and weighed each solution’s appearance, elegance, novelty, sense of humour and practicality. Competitors were not restricted to any specific format or medium; rather, they were asked to consider safe disposal and follow a simple guideline requiring that the almost 200 metric tons of plutonium piles awaiting disposal

around the world be separated into small quantities of no less than 200 grams or no more than 10 kilograms, and placed in airtight containers to prevent chemical reaction.⁴ My study of the top 50 submissions to the contest finds that the entrants (mostly, but not all, artists or designers) assumed one or more of the following roles: image maker, educator/social programmer, developer and cultural critic.

General design approaches, as well as form, location and experiences are scrutinised below. Security and safety are difficult to evaluate, and in some cases concern about them may be misplaced. The following four broad design concepts emerge:

- 1 Memorial as architectural monument: a building and a marker for people to see, know and be aware of. This is primarily a formal, image-maker approach to the problem.
- 2 Memorial as public facility: a museum and/or an event centre, an amenity overlaid on top of a liability. This concept is conciliatory, utilitarian, and mostly didactic in nature.
- 3 Memorial as tourist destination: commonly accompanied by entertainment and leisure activities. Taken as serious or humorous, this concept considers the memorial an economic investment.
- 4 Memorial as critical message and catalyst for change: primarily a political, symbolic act. This is a moralist approach intended to inform the public, hold accountable those who bear responsibility, mostly to stop plutonium production, and sometimes, quite pretentiously, even to bring peace to the world.

Memorial as Architectural Monument

Almost half of the proposals examined take the mere shape of a building as the prime task. With the plutonium buried underground in canisters, the designs search for an appropriate signifier above ground – and find it in traditional military symbols, such as bunkers, missile silos, rockets, submarines, or modern towers, forts and moats. One of these proposals belongs to J Brantley Hightower, the first runner-up, whose memorial, located along I-55 between Chicago and St. Louis, creates a radial geometry that emulates the impact area of the atomic blast in Nagasaki and disrupts the midwestern agrarian grid. Like a citadel, tall, ominous modern buildings mark the edges of the radial rays and house the plutonium storage areas and the museum. The highway cuts across the space and channels people into a large parking lot and then into a museum. Other proposals in this category allude to burial images of catacombs and mausoleums. Human skeletons and bones were used explicitly in two proposals, indicating in the first the danger of digging in the site, and in the second, the deadly damage caused to bone marrow by exposure to radiation. A glowing light, the potent symbol of radiation, is evident in numerous proposals. Many of the architectural monuments are sited near an existing plutonium production, testing or burial site, such as Rocky Flats, Colorado, or the Nevada Test Site.

Memorial as Public Facility

The creators of ten of the projects chose instead to relate to the monument as a public gathering facility, specifically a museum with the goal of educating visitors. The pure geometry of the pyramid, sphere and dome, often used in civic buildings, dominates. Brian Phelps's *Pu 94* uses 94 pyramids organised as orbiting electrons around a plutonium nucleus (based on the outdated Niels Bohr model). The facility celebrates and educates viewers about the marvels of nuclear science. The sphere, the most popular symbol of perfection and spiritual wholeness, is used in six proposals, alluding to the fragility of planet Earth, its limits and preciousness. Michael Collins, the second runner-up, designed a courtyard in Florida in which visitors walk below a solar canopy lined with floating spheres of plutonium in shallow reflective pools on the way to an exhibition room, a large spherical museum.

Memorial as Tourist Destination

In seeking to create a tourist attraction, ten proposals capitalise on consumer culture sentiments and offer family entertainment for getaway weekends. Rides, restaurants, I-Max theatres, and souvenir shops are integral to these designs. Proposals locate these 'memorials' near other major tourist destinations, such as Disney World or Las Vegas, or off major freeways and tourist routes. Several of these designs seek to provide a dramatic clash of fantasy and reality; others highlight compatibility and economic benefits. Three proposals incorporate a casino, one shaped in the form of a roulette wheel on a defunct oil rig in the ocean. But the most outrageously witty design is Konrad Schwoerke's "U.N. Plutonium Depository", a mushroom cloud-shaped building topped by a four-star restaurant and located in Orlando, Florida, with a connecting tram to Disneyworld. This tongue-in-cheek proposal crosses the line and moves the concept into the fourth category - memorial as critic.

Memorial as Critical Message and Catalyst for Change

Consumerism also pervades some of the memorials intended to serve as cultural criticism, perhaps implying that the key for change may require addressing, rather than avoiding capitalist consumer culture, which is largely responsible for the militaristic government agenda. The 13 proposals in this category can be divided into two groups: the pacifist-hopeful and the sceptical-subversive. They are characterised by mobile or decentralised and multiple memorials that 'reach' those responsible for creating the problem in the first place. Two of the memorials chosen by the first group - a flying saucer and a dirigible - are mobile, moving between decision-making places (military and government sites) and docking at plutonium production sites. For example, Tim Bragan's "Memorial as Feedback" is a large dirigible, capable of expanding and equipped with enough containment canisters to carry the world's supply of waste. The airship meets its own energy needs from wind, thus demonstrating a renewable, non-polluting alternative to nuclear power.

Everyday street elements, such as seating and display props, are used in other

proposals to contain and mark the plutonium. It is assumed that distributing the material to place it near all people might trigger actions powerful enough to stop plutonium production. Francis Cooke's "Instruments of Awareness" is a display structure made of glowing canisters on the street. It forces people to pay attention and asks for donations to support activities to stop nuclear production. Paul Hanson and Vincent Moccia's "Untitled" also inserts the memorial back into the conditions from which it arose - voters' responsibility and power. Street seating blocks and boards that contain the poisonous substance are inscribed with plain information - the names of the creators of the plutonium waste, scientists, politicians, companies, and presidents, as well as the sources, methods of processing and cost of the material.

Proposals in the second, more cynical group in this category also use images of the everyday, but borrowed from personal, domestic and utilitarian domains - an egg, an ice cube tray, jewellery, a silver ball game, and even human excrement. Icons are selected for their symbolic charge. In "Eggs and Keepers", Friederike Huth and Almost chose the egg because of its fragility and need for care. The egg-shaped container is to be shipped for safe keeping to the heads of 33 governments that produce plutonium. Jaren Joyce and Lang Boomer propose to 'freeze' and 'cool' the hot, glowing material in ice cube trays and place them on the lawn of New York's Central Park as public sculptures. Thomas Mayer's "P 239, or 18 Class-A Postcards" is a proposal to store plutonium in silver spheres suspended by titanium wires stretched around the globe and through major tourist destinations and cities. They are visible, pervasive elements, a spectacle and souvenir featured in tourist postcards. Finally, Matteo M Bologna's "Pu Pile" uses a naive, cartoonish drawing to demonstrate his shit-shaped memorial. An equivalent of ancient monuments, our excrement will be our legacy, and it can be placed where slag plutonium is excreted.

The competition initiators did not imagine anyone building such a structure. Sceptical about these proposals' practicability, but serious about their discursive value, those responsible for the competition hoped to provoke and invigorate the public, as did participants in the latter group.

ATOMIC PHOTOGRAPHY (OR ARRESTING DANGER)

In the past 20 years photographers have joined filmmakers and other plastic artists to reinvigorate public imagery and discourse. Like film, nuclear photography brings to light images of places and sights that are mostly inaccessible. But equally importantly, nuclear photography is in a unique position to "pose larger questions about the nature of beauty and perception and the depths of ambivalence in the human heart" (Covino, 1991: 27). While a few photographers interrogate social paradigms and cultural aesthetics, others fall into the trap of environmental pictorialism and moralism. The first group is represented here by photographers Robert Del Tredici, Michael Light, Paul Shambroom and Patrick Nagatani; the second includes photographers Peter Goin, Richard Misrach, Emmet Gowin, and David Hanson.⁵

The work of Montreal photographer Robert Del Tredici (1987), who founded the Atomic Photographers Guild in 1987, lays out the whole industrial subculture and the weapons' cycle, from uranium mines to refineries, plutonium production test shafts, and warhead retirement rooms. In *At Work in the Fields of the Bomb* and subsequent books, Del Tredici exposes the forces operating behind, and the people affected by, the nuclearisation of America. In his *Face to Face with the Bomb*, Paul Shambroom (2003) confronts the 'hardware', the secret facilities and the people that maintain the military's nuclear capabilities on land, sea and air. Shambroom uses his work neither to criticise nor to glorify, but only to demystify the subject. With *100 Suns*, Michael Light (2003) takes on the role of an archivist, reproducing previously classified pictures drawn from national archives and recorded by government-paid photographers in order to re-insert key questions and images into the cultural debate. And the photographer Patrick Nagatani's (1991) *Nuclear Enchantment* goes further as he "challenges us to examine the ways in which photography creates, recreates, or supports a particular history" (as cited on the website of Center for Creative Photography, 2001). Taking on the role of cultural critic, he uses staged narratives, tableaux made up of two- and three-dimensional imagery that he creates and photographs, to unravel the opposed facets of nuclear culture – awe and spectacle, danger and enchantment, the spoiled and unspoiled, death and rebirth. His surrealist collages bring out the clashes of associations that reside in the nuclear landscape drama and, most importantly, the hidden social dimension of this landscape (Janis, 1991). Del Tredici, Light, Shambroom and Nagatani use photography as a critical tool to make accessible and intelligible defining atomic events, moments and places. They go beyond photojournalism by introducing the complexity of the aesthetics and politics of nuclearisation, while leaving space for varied interpretations and truths.

In contrast, the second group of photographers probes the nuclear wastelands, the physical witness and casualty of nuclear practices more directly, which ends up complicating their task. Like the members of the first group, Richard Misrach, Peter Goin, Emmet Gowin and David Hanson seem to be united by the claim that nuclear landscapes harbour great beauty and horror side by side, but unlike their colleagues this fact makes them uncomfortable. Unable to escape beauty, and so focusing solely on the malign, their photography capitalises on the expected – ecological damage – and still uses (or abuses) beautification techniques. Their work also faces another problem: the more significant dimension of these landscapes (and the element they want most to emphasise) – radioactivity – evades the camera.

Peter Goin (1991), in *Nuclear Landscapes*, takes on the roles of researcher, explorer and witness. His photographs frame the physical remnants of the ground tests and portray them as icons of the nuclear age, relics of lost civilisation, and visual metaphors of the nuclear legacy. Goin endeavours "to articulate ideas about landscapes of fear", but to avoid beauty (Goin, 1991: xxii). According to author and critic Michael Covino, however, Goin's work conveys instead an ordinary landscape, untouched by destruction, and deprived of the element of fear. And of Goin's claim of avoiding beauty, Covino asks: "Why can't beauty be mixed

with horror?” and argues that we do not need such works to convince us to feel bad about nuclear blasts (1991: 28). Richard Misrach (1990), in *Bravo 20*, carefully frames test sites, portraying traumatised places of otherworldly magic as he displays carcasses of war machines and bombs, dead fish in a dried pond, bloody ponds, and the wounded earth. Misrach blames the politics behind the “military occupation” of the Nevada Test Site land and laments the intrusion on the biblical desert and the expulsion of God’s powers. Misrach writes: “The work I do is a means of interpreting unsettling truths, of bearing witness, and of sounding an alarm” (Misrach, 1992: 90).

Another photographer, Emmet Gowin (see Reynolds, 2002), also falls short of disclosing new ideas. Gowin’s aerial photographs of the American West suggest the abstract formal beauty of natural landforms marked by the disquieting scars of human activity. The human body, as image and metaphor, is exploited to convey the message of an abused landscape. Gowin’s deep religious undertones, typical of traditional pictorial landscape photography, limit the message of his work. Finally, the photographer David Hanson (1997), in *Waste Land*, takes on an archivist’s role in his aerial colour pictures of hazardous-waste sites. Hanson’s thesis is: “We attempt to rival the power of ‘the gods’ and as punishment for our hubris, we cast ourselves into a Paradise Lost.

The American landscape at the end of the second millennium has become a contemporary reflection of our ancient vision of the Apocalypse” (Hanson, 1997: 151). A furious prophet, Hanson returns to allusions of the monument as well as the garden. He writes that “It seems frightening yet strangely appropriate that the most enduring monuments the West will leave for future generations will not be Stonehenge, the pyramids of Giza, or the Cathedral at Chartres, but rather the hazardous remains of our industry and technology ... Instead of the Zen garden of Kyoto’s Royanji, we leave behind vast *gardens of ashes and poison*” (Hanson, 1997: 150; italics added). Hanson believes that we have transformed our natural world “from wilderness to pastoral landscape to industrial site and now to wasteland” (1997: 151). Some would argue otherwise; we have transformed our wilderness to nuclear wilderness and now to a post-nuclear wilderness.

POST-NUCLEAR WILDERNESS (OR GARDENS OF ASHES AND POISON)

“Post-nuclear wilderness”, a term coined by John Beardsley in his essay on the Savannah River installation (1998), describes a curious trajectory found in many nuclear landscapes. Almost all the nuclear research, production, test and burial sites have been formally, or by default, guardians of large tracks of undeveloped land. The fenced-off lands, which provide a safety and security buffer surrounding these facilities, make up more than half of the area. For 60 years the public was barred from thousands of acres of both polluted and unpolluted land that are now reverting back to the public (Hiss, 1998: 4). Several recently opened sites are being converted to nature reserves, turned into a ‘Found Eden’.

America’s first “National Environmental Research Park” label was bestowed

on the Savannah River installation in 1972. The 310-square-mile area, which hosted a factory for the production of tritium and plutonium for nuclear warheads, is also the largest uninhabited area on the eastern seaboard, made up of timber plantation and Carolina bays and swamps. Surprisingly, the severely contaminated site is also a safe haven for endangered species and thriving wetland ecosystems (Beardsley, 1998: 144). Since nuclear processing began in 1951, the area has become a laboratory for long-term ecological research on field succession, competition, radioecology (the movement of radioactive contaminants and their impact on the environment), and genotoxicity (the study of harmful effects of chemicals and radioactive contaminants on the genetic integrity of animals). With no significant evidence of change in the life expectancy or reproductive viability of local species, scientists say that greater threats to the site are posed by human development than by radioactivity. "It would be one of the great ironies of the cold war if factories for weapons of mass destruction turn out to be among the safest havens we can offer the non-human species with which we share the landscape. Call it the post-nuclear wilderness", writes Beardsley (1998: 143).

But what Beardsley calls post-nuclear wilderness and views as laboratories for genotoxicity and radioecology, Alexander Wilson (1991) deems to be camouflage and deceit. In his intriguing essay on nuclear power and energy in North America, Wilson pinpoints "dystopian landscapes" – landscapes that demonstrate the physical and social continuum of energy, capital and war. One of these, Bruce Energy Center in Lake Huron, Canada, a major nuclear power plant, is surrounded by a 'nature preserve' and bounded by a 16-foot-tall fence. The nature planted inside the fence and the animals stocked there are captive, detached from the outer world. The preserve is officially used as a laboratory for researchers to study the effects of low-level emissions on living tissue, but Wilson prefers to think of it as a litmus test warning of radiation releases, with a disguised motive. "The animals", claims Wilson cynically, "have another purpose, however, and that is to illustrate the safety and naturalness of nuclear power" (1991: 275).

In the notorious Hanford Reservation in Washington State, the Department of Energy in 1968 likewise set aside 120 square miles as an Arid Lands Ecology Reserve, and the area north of Columbia River was designated a wildlife refuge in the 1970s (Kaplan and Adams, 1986). National research laboratories also set aside large tracts for wildlife refuges, and provide public access to them. For example, the Argonne National Laboratory south of Chicago surrounds itself with a publicly accessible forest preserve. In other places, large closed areas are being opened to public use. The recently closed Rocky Flats nuclear facility near Golden, Colorado, is turning into the Rocky Flats National Wildlife Refuge. And the 25,000 acres of the former Joliet Arsenal in Illinois is being transformed from a military base producing weapons to the Midewin National Tallgrass Prairie Park. Finally, 18 years after the atomic disaster in Chernobyl, the city and its surrounds, frozen pictures of human life in 1986 USSR and overgrown urban wilds, are braced for thousands of curious tourists equipped with Geiger devices, and will likely become a model of the post-nuclear landscape.

Diametrically opposed, and yet dialectically compatible, atomic weapon and power plants and secret gardens meet and overlap in highly charged landscape junctures. The artist Robert Smithson, who was attracted to the devastated wastelands of New Jersey's Meadowlands and Utah's strip mines for their aesthetic intrigue and intellectual challenge, pondered their potential to be recycled into new cultural projects. Post-nuclear landscapes demand the same attention; and we should respond not by applying a ready-made formula, whether that of 'native' nature reserve or Disneyland circus, but by exploring a potent and creative cultural continuum of possibilities. A wind power facility of 325 wind turbines has been considered for the Nevada Test Site, covering nearly half of the former atom bomb range. Architects, photographers, filmmakers and landscape architects can invest these charged territories with new meanings and envision a post-nuclear landscape that bridges the gap between our technological capabilities of destruction, and our ability to harness those same forces creatively.

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ENDNOTES

- 1 Radioactivity was discovered in 1895; the atom bomb was first tested and put to military use in 1945. The words "atomic" and "nuclear" are used here interchangeably.
- 2 In the United States today, there are more than 20 million acres of military bases (including military-owned and privately operated facilities and testing grounds); 110 commercial nuclear reactors (many on the East Coast); more than 300 sites related to the production of nuclear reactors or weapons, owned privately or by the federal Department of Energy; around 10,000 nuclear warheads in military bases and launch sites; and several hundred radioactive dumpsites.
- 3 Plutonium-239 is a fuel for nuclear fission, produced in nuclear reactors from uranium-238.
- 4 According to the *Bulletin's* editor, contrary to what many people believe and despite much public scepticism, even dangerous weapon-grade plutonium containing a high percentage of plutonium-239, when handled properly, can be safe. Other substances, such as cyanide, mercury, cesium and strontium pose a greater risk to people (Rothstein, 2001).
- 5 In 1999, "The Altered Landscape" exhibition (subsequently a book), curated by Peter Pool at the University of Nevada, assembled a collection of works by 30 photographers (including the eight presented here) dealing with the late-twentieth-century human impact on the land (see Pool, 1999). Also in this book, see David Hickey's excellent critique of these photographers' work.