

T H E
B  M B
I N T H E
W I L D E R N E S S

Photography and the Nuclear Era in Canada

J O H N O ' B R I A N





Brenda and David McLean
Canadian Studies Series

UBC Press is proud to publish the Brenda and David McLean Canadian Studies Series. Each volume is written by a distinguished Canadianist appointed as a McLean Fellow at the University of British Columbia, and reflects on an issue or theme of profound import to the study of Canada.

W.H. New, *Borderlands: How We Talk about Canada*

Alan C. Cairns, *Citizens Plus: Aboriginal Peoples and the Canadian State*

Cole Harris, *Making Native Space: Colonialism, Resistance, and Reserves in British Columbia*

John F. Helliwell, *Globalization and Well-Being*

Julie Cruikshank, *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination*

Sherrill Grace, *On the Art of Being Canadian*

R. Kenneth Carty, *Big Tent Politics: The Liberal Party's Long Mastery of Canada's Public Life*

Tina Loo, *Moved by the State: Forced Relocation and Making a Good Life in Postwar Canada*

C O N T E N T S

Preface: Radioactive Footprints / xiii

Introduction: Still Photographs / 1

1 Nuclear Industry / 23

2 Chalk River / 45

3 Cold War Defence / 69

4 Cloud Shadows / 85

5 Atomic Soldiers / 101

6 Mass Protest / 117

7 Camera Targets / 135

Epilogue: Deadpan Pictures / 151

Acknowledgments / 157

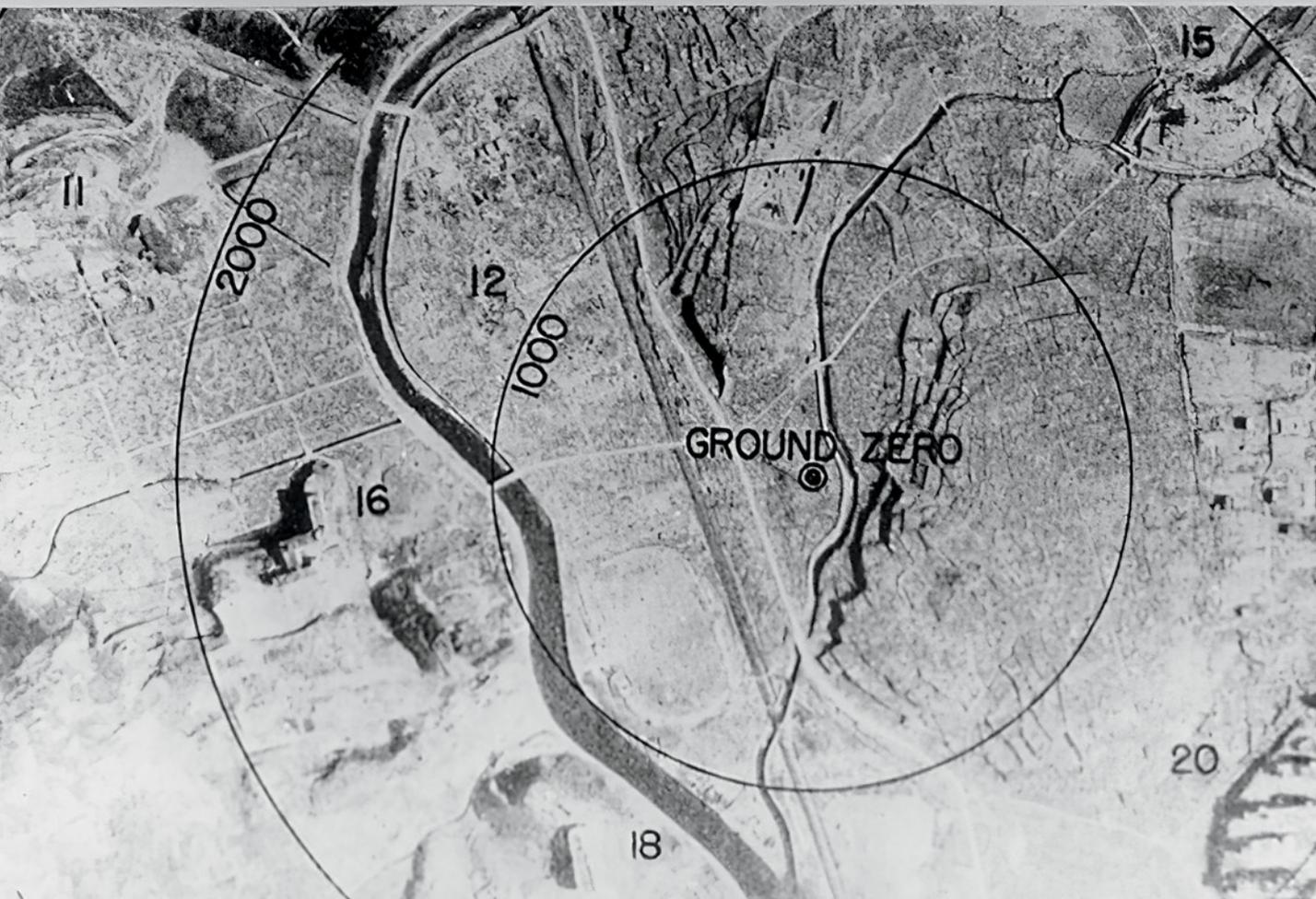
Atomic Timeline / 159

Notes / 163

Selected Bibliography / 193

List of Illustrations / 203

Index / 211



P R E F A C E

Radioactive Footprints

DURING THE SECOND WORLD WAR, CANADA WAS A MEMBER OF THE MANHATTAN Project, the consortium that developed the atomic bombs dropped on Hiroshima and Nagasaki. The impact of Canada's nuclear programs has been felt ever since the destruction of those cities in 1945. The extent of the programs – the reach of Canada's nuclear footprint – has been global. This book focuses on what photography can demonstrate (or not demonstrate) about the size and shape of the footprint. Some of the revelations are striking. The photographs discussed range from those released by military authorities, to the documentary images of Montreal artist Robert Del Tredici, to the atomic ephemera of consumer culture. The book contends that photography is one of the primary ways, if not the primary way, that nuclear episodes and activities are represented and remembered. Photographs provide a link between the nuclear past and the nuclear present, and play a mediating role in shaping a public image of events. They help to show that the military atom and the civilian atom, notwithstanding disclaimers to the contrary by governments and corporations, are intimately connected. A central focus of the book is on nuclear risk: Do photographs alert viewers to nuclear threat, numb them to its dangers, or by some strange calculus do both at the same time?

| **Figure P.1:** Nagasaki 1945 – Before and After, 1945.



I started paying attention to issues of nuclear risk and representation in the 1980s, when I was writing about postwar visual art. You cannot discuss Barnett Newman and Jackson Pollock, or Joyce Wieland and Roy Kiyooka, without also talking about Cold War anxieties. Kiyooka, a Japanese Canadian artist branded an enemy alien during the Second World War, knew more than most about Cold War tensions. When Kiyooka represented Canada at the 1970 Osaka world's fair, he arrived in Japan while the fairgrounds were still under construction and took photographs of gloves discarded by workers on the site. Mixed with concrete dust and rainwater, some gloves had turned to "stone." [Figure P.2] "The scattered gloves haunted the site with the specters of Hiroshima and Nagasaki," one observer writes. "With the fiery disappearance of bodies marked in the silent twists of their folds [they offered] traces of not only those vaporized but also the *hibakusha*," victims of the bombings who survived.¹ Several vertical sequences of photographs from the *StoneDGloves* series offer a visual parallel to an atomic explosion, where the white of the flash turns to black ash. A single glove shown in a sequence of seven photographs progressing from light to dark is scarcely visible at the extremes. The over-exposed print at the top is almost white, the under-exposed print at the bottom almost black.

Like most of my generation, those born during the Second World War, I was personally caught up in nuclear events long before the 1980s. When the threat of nuclear conflict between the United States and the Soviet Union heightened at the beginning of the Korean War in 1950, I was a first-grade student living just outside New York City. At the time, my father, a career officer in the Royal Air Force, was stationed nearby at West Point (I had my tonsils removed in the military hospital there and can still taste the ether used to knock me out), and I recall doing duck-and-cover drills in class that sent me scrambling beneath my desk. [Figure P.3] My father talked sparingly about his experiences in the RAF, skirting questions about his participation

| **Figure P.2:** Roy Kiyooka. *StoneDGloves*. 1970.



| **Figure P.3:** Unknown. *Duck-and-Cover Drill in School.* c. 1950.

in the Battle of Britain and his postwar assignments to the United States and Germany. When he died, I learned more from his obituaries in British and Canadian newspapers than I did from any conversation I had with him.² One of his postings was as commanding officer of RAF Leuchars in Fife, Scotland, the first RAF supersonic base equipped with fighter planes capable of intercepting incoming Soviet bombers armed with nuclear weapons. We lived in staff quarters just beyond the perimeter of the base, and I can still remember the sound of aircraft taking off and landing. I could determine whether they were coming or going by the telltale pitch of their engines, like the tick-tock of the clock in the crocodile's stomach in *Peter Pan*. But I cannot remember forming any idea of what the planes were for.

In a similar way, when I was at Trinity College School in Port Hope, Ontario, as a boarder in the late 1950s, and Eldorado Mining and Refining (now Cameco Corporation) was processing uranium ore on the town's waterfront, I did not think to ask what the factory



Figure P.4: Postcard. *The Eldorado Radium and Uranium Extraction Plant, Port Hope, Ontario, Canada.* c. 1950.

was doing. I failed to notice, for a second time, that I was on the periphery of a nuclear site. As the “oldest extant nuclear facility in the world,” Eldorado was producing uranium dioxide and uranium hexafluoride for shipment to the United States under military contract.³ The company was a pioneer in the secret as well as the material sides of the atom, in what the fiction writer Philip Pullman calls “uranium atomcraft.”⁴ The factory appears on a postcard from about 1950 that glows with unnatural blues and reds so intense they might well have been manufactured in an experimental corner of the plant. [Figure P.4] In later chapters, I will have more to say about atomic postcards and how they function to domesticate nuclear threat.

Canada’s first nuclear town, as Port Hope once named itself, was also releasing radionuclides into the environment.⁵ The spread of contamination eventually resulted in the most costly environmental cleanup by a municipality in Canadian history, a cleanup still ongoing, sounding a public alarm about the problem that radioactive waste presents for society. During the construction of St. Mary’s school in the town, Eldorado donated sandy fill for the cafeteria, gymnasium, and parking lot. In 1975, when the fill was found to contain levels of radon gas that were as high as those in a uranium mine, the school was evacuated and shut down. This signalled that much of the town was toxic.⁶ In the photograph *St. Mary’s Elementary School*, Port Hope, Ontario, taken from a high angle by Robert Del Tredici after the school had been decontaminated and reopened, children run in the playground as if the school had never been exposed to the gas produced by the radioactive fill. [Figure P.5] The height



| **Figure P.4:** Robert Del Tredici. *St. Mary's Elementary School*. 1982.

from which the photograph is shot allows Del Tredici to bifurcate his composition. On one side is the hard, immobile brick wall of the school building, on the other the movements of children at play. The inorganic presses against the organic. For those who are aware of the contamination, the image underscores the memory of what happened. The individuals in the school had been exposed to radiation, exposed to an act of “slow violence,” to use a term coined by the environmental scholar Rob Nixon.⁷

My childhood brushes with nuclear activities lay dormant for decades. Unlike the time traveller in Chris Marker’s 1962 film *La Jetée* or the cultural theorist Paul Virilio, who was obsessed with bunker ruins, I was not haunted by recurring images of disaster.⁸ I did not cover my face with my hands to block out premonitions of catastrophe, as the woman does on the viewing platform of the airport terminal in *La Jetée*. [Figure P.6] But if a lack in the past makes a claim on the present, as the artist Mary Kelly insists, it was only a matter of time before images of the bomb and nuclear energy caught up with me.⁹ Part of what interests Kelly in her feminist practice and me in my research on nuclear representation is the gap between generations. This gap also interests the political theorist Hannah Arendt, who distinguishes between her pre-nuclear generation and that of Kelly and me in her book *On*



| **Figure P.6:** Publicity still from *La Jetée*. 1962.

Violence. “The possibility of doomsday,” Arendt observes, was our generation’s “first decisive experience in the world.”¹⁰ Those born during the Second World War – who were alive during the bombing of Hiroshima and Nagasaki – are psychologically disposed to return to sites of nuclear catastrophe.

In my travels through the nuclear era, I have learned that atomic flashpoints should not be emphasized at the expense of the everyday activities of the nuclear industrial complex. The nuclear complex has seeped into almost every corner of Canadian life.¹¹ By bringing the words “bomb” and “wilderness” together in the title of this book, I want to draw attention to Canada’s nuclear history. Canada is not *terra nullius*, a place where nothing happens, though it is often described that way. The First Nations have inhabited the land for thousands of years. Their occupation includes the territory around Port Radium and Great Bear Lake, the traditional lands of the Sahtu Dene people, from which Eldorado shipped uranium ore to its refinery in Port Hope. Like nuclear facilities in Los Alamos, New Mexico, the Port Hope plant has not only been an environmental polluter because of its mass production of uranium dioxide and uranium hexafluoride, but it has also been a major employer in the town. Society’s relationship to nuclear weapons and nuclear energy is rarely straightforward.

This relationship is also explored in *Through Post-Atomic Eyes*, an anthology that I edited with Claudette Lauzon.¹² It brings together the nuclear imagery of artists and photographers with the writings of scholars who specialize in quantum physics, military geography, anthropology, big data, art history, performance studies, and forensic architecture.¹³ These artists and scholars share our conviction that atomic culture since Hiroshima and Nagasaki has

been conditioned by matters of visibility. At the heart of the two volumes lies this question: What might it mean to see the world through post-atomic eyes that have been transformed by Hiroshima and Nagasaki?

Photography has the capacity to shape and reshape perceptions of the nuclear enterprise by revealing hidden activities and risks. *StoneDGloves* by Kiyooka and *St. Mary's Elementary School* by Del Tredici both help to alter nuclear perceptions. I am not suggesting that by throwing light on what has been obscured, by revealing the disfigurements in modern life since the development of the atomic bomb, photography can repair what has been misshapen.¹⁴ Bringing nuclear issues to light cannot mend what has been damaged. Nor am I suggesting that photography can operate outside history and the nuclear events it portrays; photography, like the bomb, is an agent of history. To build more powerful weapons, the United States and other countries with the bomb developed faster cameras that aided the scientific measurement of blast yields. Better cameras led to better photographs, and better photographs led to better bombs. Photography has consistently haunted the nuclear imagination by disclosing what has been masked.



INTRODUCTION

Still Photographs

PHOTOGRAPHS MARK EVENTS.¹ CONSIDER IMAGES OF HIROSHIMA AND Nagasaki, Bikini Atoll and the Nevada Test Site, Chernobyl and Fukushima, Port Radium and Port Hope, Chalk River and Bruce Power. The bombings of Hiroshima and Nagasaki are part of our collective memory less because of books written about the devastation they caused, or because of witness accounts provided by the hibakusha, than because of a visual archive of emblematic photographs.²¹ The enriched uranium and plutonium in the atomic bombs came from ore mined at Port Radium in the Northwest Territories that had been refined at Port Hope in Ontario.³ Photographs exist of both Canadian sites. The filmmaker Richard Finnie photographed an employee of Eldorado Mining and Refining, which owned the Port Radium mine, resting his hand on sacks of pitchblende concentrate rich in uranium.⁴ [Figure 1.1] The image catches the eye not only because of the subject matter but also because of the repetitive pattern produced by the white labels on the burlap sacks. The sacks are waiting to be transported across Great Bear Lake and then south to Alberta for further shipment by rail eastward to Port Hope. The Sahtu Dene people, living in the village of Déline on the western shore of the lake, were employed as carriers of the ore without knowing what it was for. Some slept on the sacks.

| **Figure 1.1:** Richard Finnie. *Sacks of Pitchblende Concentrate, Port Radium*. 1939.

Where nuclear activities have occurred, photographers have often been there to frame them. They have been there to record what happens and sometimes to assist in what happens. During the Cold War, they worked primarily in black-and-white rather than colour. This was for professional, technical, and aesthetic reasons, and is reflected in the large majority of examples reproduced in this volume. The Swiss American photographer Robert Frank wrote that “black and white is the vision of hope and despair.”⁵ It offers nuanced gradations of tone and texture, and carries more emotional weight than colour. It has gravitas. But black-and-white was also chosen for gendered reasons. Especially in the early decades of the Cold War, colour was coded as feminine.⁶ The masculinization of nuclear technologies called for black-and-white.

An extensive literature discusses the nuclear era, especially as it relates to the United States, the only nation so far to have used atomic weapons in war.⁷ New books and articles appear daily, many containing photographs.⁸ But few reflect on nuclear optics, on the mediating role of photography in forming an image of the bomb and commercial nuclear energy. Two exceptions are *The Nuclear Culture Source Book*, edited by Ele Carpenter, which focuses on contemporary visual art, and *Invisible Colors: The Arts of the Atomic Age*, by Gabrielle Decamous, which brings historical and contemporary nuclear art together.⁹ Even fewer books reflect on Canada’s role as a nuclear power, never mind providing a critical perspective on it. *Canada and the Cold War*, by Reg Whitaker and Steve Hewitt, is one such inquiry, and Peter C. van Wyck’s *Highway of the Atom* is another.¹⁰ Both have contributed to this study. The former addresses significant aspects of the Cold War in the public life of Canada, using press photographs as visual documentation; the latter brings archival information and story together to produce narratives about Port Radium, Déline, and the Sahtu Dene people. It includes photographs as well, some by the author.

Whitaker and Hewitt note that Canada, as a member of the Manhattan Project, the bomb-building consortium led by the United States, constructed the first nuclear reactor located outside the United States. The reactor was “born violent,” its purpose to produce plutonium for nuclear weapons.¹¹ It became operational in August 1945 at Chalk River, Ontario, a few weeks after the Hiroshima and Nagasaki bombings. The heavy water technology employed in the design was transferred in following decades to the CANDU reactor program, and Consolidating Mining and Smelting Company of Canada in Trail, British Columbia, produced some of the heavy water required to run the reactors. Chalk River was also the site of another first: the first major reactor accident in the world, on December 12, 1952, when the NRX (National Research Experimental) reactor experienced a partial meltdown. (Future president Jimmy Carter, a naval officer with the US nuclear submarine program, participated in the cleanup and suffered radiation poisoning.) In addition, Chalk River Laboratories pioneered the development of medical isotopes as well as the management of radioactive waste. In 1974, at Pinawa, Manitoba, it built one of the earliest test facilities for high-level nuclear waste disposal, though the site was never used.¹² More recently, in 2012, Bruce Power’s group of reactors on the eastern shores of Lake Huron in Ontario became the largest nuclear plant in the world.¹³



| **Figure 1.2:** Royal Air Force. *Peter O'Brian Seated in the Cockpit of a Hawker Hurricane.* 1940.

Van Wyck is more skeptical than Whitaker and Hewitt about the ability of language and photography to convey adequately what occurs during nuclear events. He questions whether it is possible to grasp what happened at Port Radium and D eline, either by visiting the mine and village or by looking into the past. His rhetorical strategy in *Highway of the Atom* is to unite “theory” with “story.”¹⁴ Testimony and narrative can register events forcefully, he says, but they cannot always clarify matters. He quotes the philosopher Jacques Derrida: “There is no testimony that does not at least structurally imply in itself the possibility of fiction, simulacra, dissimulation, lies, and perjury.”¹⁵ In other words, stories are slippery. Van Wyck, like Derrida, insists on the fragmentary nature of testimony and distrusts claims to certainty. The writer and scholar Julie Salverson, who accompanied van Wyck on his travels along the atomic highway, also distrusts claims to certainty.¹⁶ She expresses her doubts and anxieties in an atomic memoir, *Lines of Flight*. The spectre of nuclear winter haunts its pages.

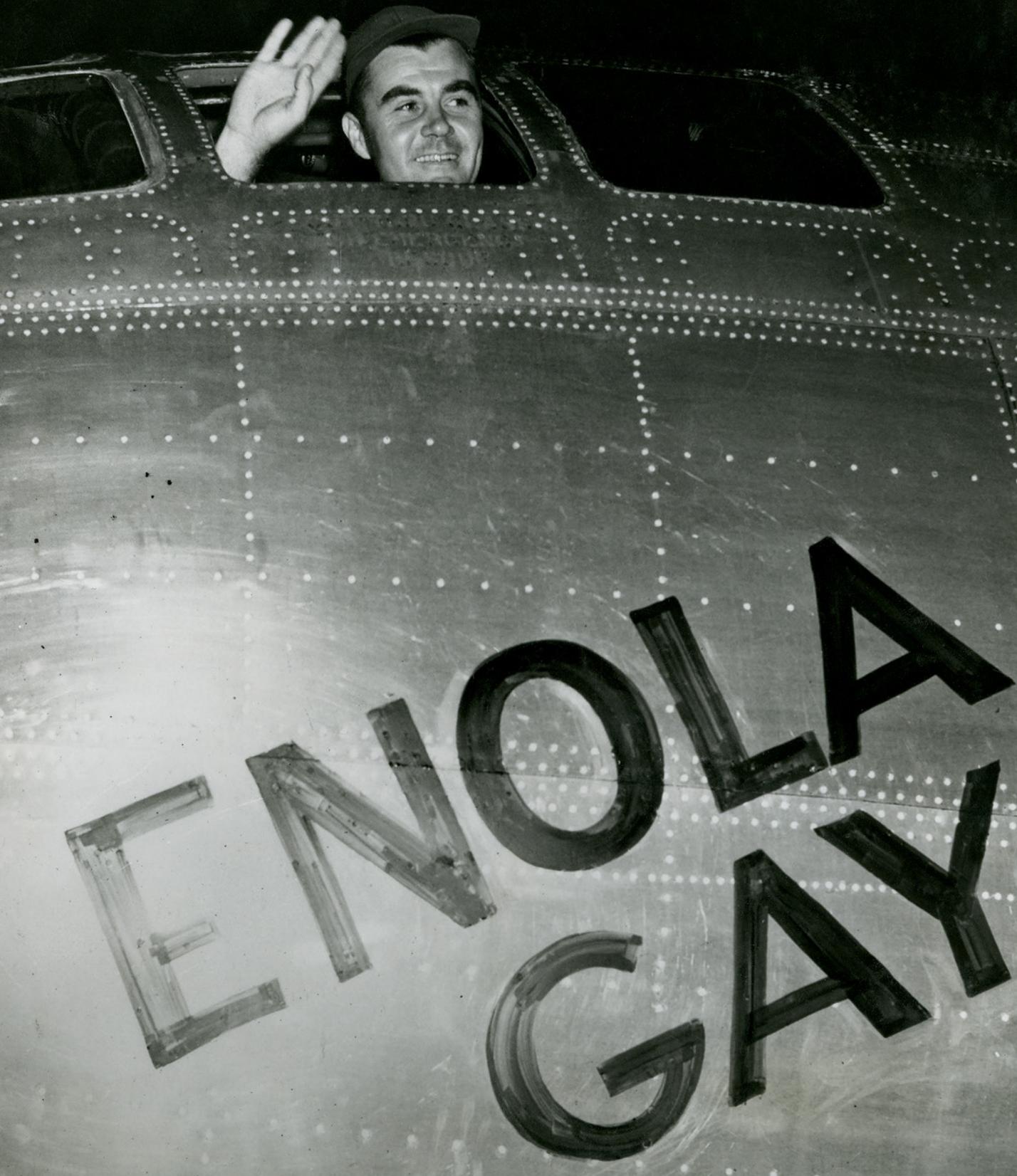
The plot lines of intersecting photographic and verbal inscriptions on nuclear matters tend to emerge from the underbrush of history as much as from the examined spaces of major atomic events. Photography, like language, does some of its most telling work in the recesses of historical space and time. Susan Sontag argues in her critical writings that photography fails to provide the narrative structure or interpretive coherence offered by language. Photographs need to be supplemented with texts and captions to produce understanding, she insists, whereas language can speak to disagreement and build understanding without photographs.¹⁷ On its own, she would argue, photography does not have the expressive power to convey the pain of the

Sahtu Dene people, the hibakusha in Hiroshima and Nagasaki, or the survivors of Fukushima Daiichi.¹⁸ But there are also constraints and contingencies to language. Shortly after publishing *Precarious Life: Powers of Mourning and Violence* in 2004, Judith Butler wrote a response to Sontag's ideas on photography. Her essay "Photography, War, Outrage" questions Sontag's separation of the work of photography from the work of writing. When Sontag "faults photography for not being writing," on the grounds that it lacks narrative continuity, she fails to grasp how it works.¹⁹ Photographers build interpretation by choosing one scene over another, Butler suggests, by framing what they are looking at and producing visual narratives. The chosen frame carries their purpose, and that purpose is implemented through the frame. Butler cautions against privileging language over photography, a position that strikes me as correct.

Take two photographs of pilots in the cockpits of their planes, one well known, the other little known. [Figs. 1.2 and 1.3] Now imagine that W.G. Sebald, the author of *Rings of Saturn* and *Austerlitz* as well as of accounts of bombing campaigns conducted during the Second World War, came across the less-known example in an English thrift store.²⁰ During an interview about photography, Sebald mentioned that he often visited thrift stores and spent time sifting through boxes of discarded photos.²¹ Some of the prints he purchased on his thrift store visits are published in his books, along with snapshots he took himself. Sebald had a sophisticated understanding of photography as a medium, commenting that many photographs lead a "nomadic existence" until they are "rescued."²² He recognized that photography is inextricably bound up with modernity as well as with language. It is a phenomenon that inhabits almost every aspect of modern life, from birth to death, war to peace, art to advertising, theoretical physics to applied physics, uranium mining to atomic-bomb building (my list, not Sebald's).

Sebald put great store in his subjective response to photographs as well as in the stories that emerged from them. "Thinking hypothetically" was his term for the process.²³ So it is reasonable to ask how he might have responded to the lesser-known image. Photographs of air force pilots sitting in the cockpits of their planes are a dime a dozen in thrift stores, and Sebald might have skipped over it and continued to look through the box of loose prints. Like so many genres of photography – *cartes-de-visites*, wedding pictures, snaps of family reunions – photographs of posed military personnel are all the same and all different.²⁴ For Sebald to have paused over the image, a generic picture of a pilot wearing a leather helmet at the controls of his plane, something would have had to catch his eye: the inscription "China-British" painted on the fuselage, perhaps, which was the kind of detail that led the author into literary detours – Sebald's literary detours in his novels are celebrated – or, maybe, the label "Canada" sewn on the shoulder of the uniform. As a chronicler of war, Sebald might have wondered about the message conveyed by the words China, British, and Canada in close proximity to one another. He would not have wondered, however, about what kind of

| **Figure 1.3:** US Air Force. *Paul Tibbets Waving from the Cockpit of the Enola Gay*. 1945.



ENOLA
GAY

photographer took the picture. The sharp focus, the positioning of the camera with the sun behind it, and the tight composition announce that it was a professional.

Unless it was written on the back of the print, Sebald could not have discovered why it was taken or the name of the pilot. The absence of this information might have been the beginning of a story for him. He might have seen the picture as representing a missing person, someone no longer alive. Like Roland Barthes in his last book, *Camera Lucida*, Sebald was emotionally susceptible to the stories that arise from photographs at the same time as he was conscious – acutely conscious – of their unreliability.²⁵ He did not privilege photography over language, or vice versa.

The little-known photo was taken in 1940, shortly after the Battle of Britain, and the well-known one in 1945, a few days before the end of the Second World War. The aircraft are a Hawker Hurricane fighter plane, photographed in daylight, and a B-29 bomber, shot at night using a flash that lights up the words “Enola Gay”, the name of the pilot’s mother. The primary weapons on board are, respectively, a machine gun and an atomic bomb. The planes are piloted by my father, a Canadian officer in the Royal Air Force, and Paul Tibbets, an American officer in the US Air Force. They are on the same side of the conflict, one in the European theatre (notwithstanding the “China-British” inscription indicating that construction of the aircraft was supported by expatriates) and one in the Pacific theatre.²⁶ When the pictures were taken, both pilots had been assigned their targets: the German Luftwaffe, on the one hand, and the Japanese city of Hiroshima, on the other. The difference between the targets and the weapons used to destroy them is the difference between one era and another, between the pre-nuclear era and the post-Hiroshima era. The industrial technologies of the pre-nuclear era could be more or less controlled; the post-atomic technologies of nuclear destruction could not. As Rey Chow observes in *The Age of the World Target*, the atomic bomb makes a target of everyone.²⁷

All statements about nuclear events are inherently unstable, Derrida declares in his article “No Apocalypse, Not Now (Full Speed Ahead, Seven Missiles, Seven Missives).” He argues that nuclear activities and threats are always rhetorical in structure. Drawing on Plato, he refers to nuclear conflict as a *pharmakon*, something that has the ability to both injure and cure.²⁸ Radiation can be beneficial as well as harmful; it can cause cancer and it can fight cancer. Regardless of which side of the radiological equation is being discussed, the other side is always present, as demonstrated in Chris Lund’s photograph *Radium Treatment of Lip Cancer, Toronto General Hospital*, where the tools of the cure look as brutal as the disease. [Figure 1.4] In this close-up image of a cancer patient’s face during an operation, the upper and lower lips are taped down, while the gloved hands of the surgeon hold instruments of repair. A label in the lower left corner reflects the high cost of radium at the time: “Caution, Radium, Do Not Throw Away.” The two sides of the equation are joined together in the photograph. The positive and the negative, as Derrida says, cannot be separated.

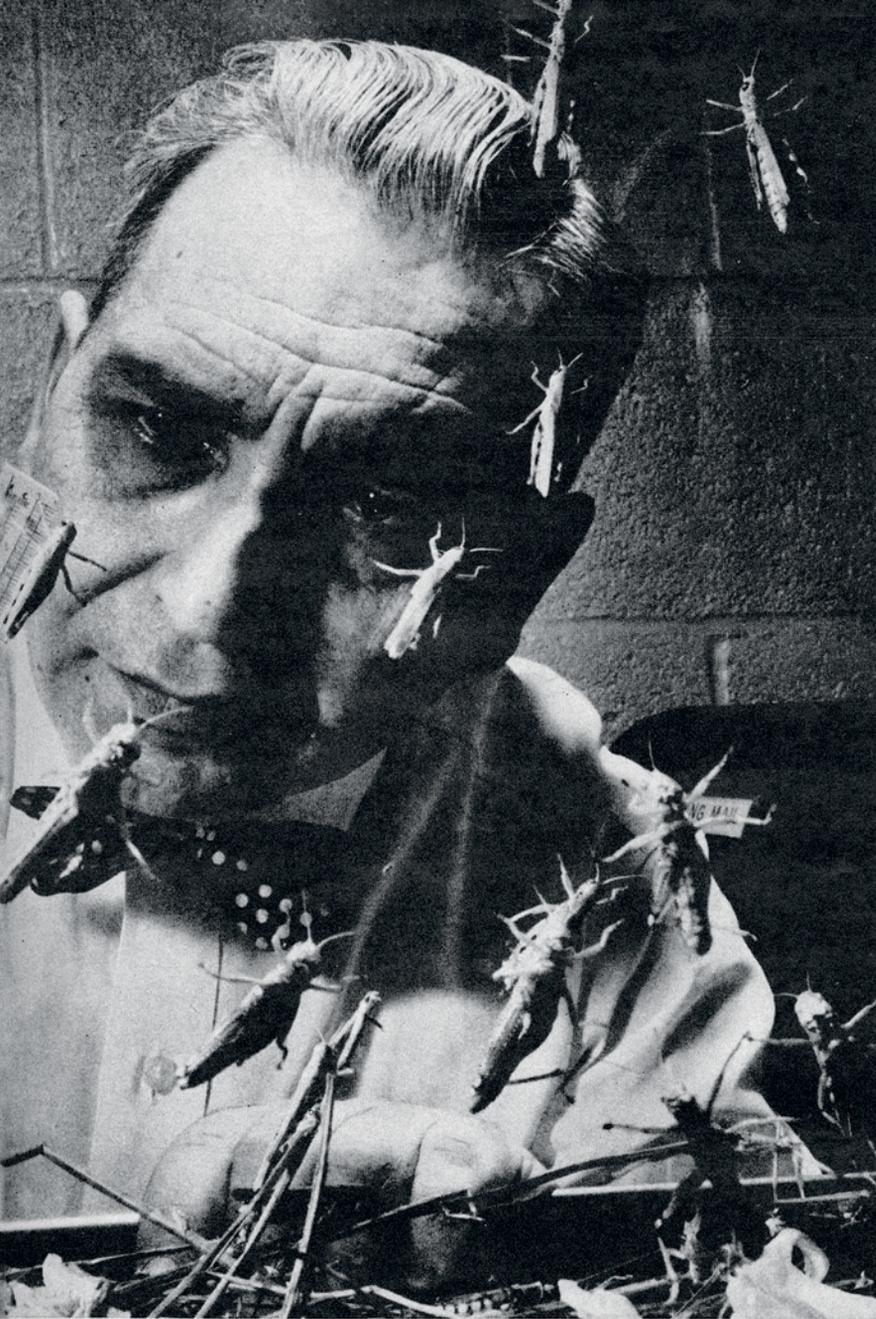
A 1955 photo-essay in *Life* magazine called “Science Tackles Radiation Peril” offers another example of the *pharmakon* at work.²⁹ [Figure 1.5] An overview of the physiological effects



| **Figure 1.4:** Chris Lund. *Radium Treatment of Lip Cancer, Toronto General Hospital. 1949.*

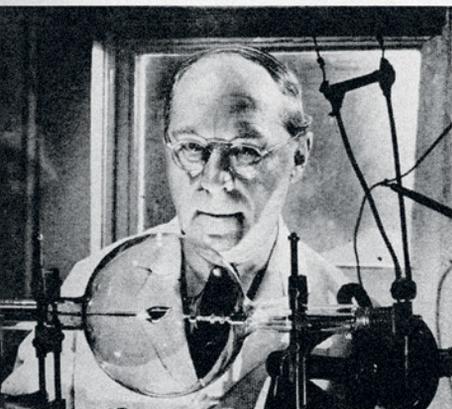
of atomic weapons testing, it incorporates statements solicited from scientists who knew about Exercise Desert Rock in the 1950s, the program in which American and Canadian soldiers were ordered to advance across a simulated battlefield toward ground zero during nuclear detonations at the Nevada Test Site. They were not issued with protective gear, so they absorbed large doses of radiation.³⁰ In “Science Tackles Radiation Peril,” Alfred H. Sturtevant, a geneticist, claims that “the last H-bomb test alone probably produced more than 70 human mutations which are likely to produce large numbers of defective individuals in the future,” whereas Gioacchino Failla, a physicist, states that “the question of how many H-bombs can safely be tested is irrelevant. To remain free, we must develop powerful nuclear bombs. We must continue our test program.”³¹ The most striking image in the photo-essay is of another scientist, Theodore Tahmisian, who studies the effects of radiation on grasshoppers. With his deeply shadowed eye sockets, he seems hypnotized by the insects crawling around him, as if he might soon be overwhelmed by them, reinforcing the trope of the mad scientist overcome by his research. The photograph of Tahmisian and his grasshoppers occupies almost half the page.

The statements by Sturtevant and Failla, which seem strongly at odds with one another, prove to be interdependent. They are joined together in the rhetorical structure that, as Derrida asserts, conditions all nuclear discourse. Failla’s argument that atomic weapons are beneficial



HOPEFUL DRUG is about to be injected into a mouse being weighed at Columbia University laboratory. Drug, beta-mercaptoethylamine, is one of several which raise animals' resistance to radiation.

← **PROVOCATIVE DISCOVERY** was made by Theodore Talmisian, who found that the effects of radiation on grasshopper eggs (produced by colony, left) do not show up while the eggs are in hibernation.



NOBEL PRIZE-WINNER Hermann J. Muller, a geneticist: "Atomic warfare may cause as much genetic damage, spread out over future generations, as the direct harm done to the generation exposed."



GENETICIST Alfred H. Sturtevant says, "The last H-bomb test alone probably produced more than 70 human mutations which are likely to produce large numbers of defective individuals in the future."



PHYSICIST Gioacchino Failla: "The question of how many H-bombs can safely be exploded is irrelevant. To remain free we must develop powerful nuclear bombs. We must continue our test program."

is predicated on their capacity to harm. They extend the possibility of “freedom” and political stability, he maintains, through their ability to annihilate enemy armies and enemy states. They are a deterrent. Sturtevant’s comment that nuclear weapons are destructive is also predicated on their capacity to harm. They can cause human mutations and can also annihilate armies and states. Deterrence might fail, he says, and the world could be destroyed.³² Nuclear weapons, according to Derrida, are “the absolute *pharmakon*.”³³

Methodologically, this book occupies a position somewhere between the critical history offered by Whitaker and Hewitt in *Canada and the Cold War* and the deconstructive stories narrated by van Wyck in *Highway of the Atom*. Much of my research has been undertaken in institutional archives in Canada and elsewhere, and I am indebted to the historical documentation and photographs provided by them.³⁴ But I am less likely than Whitaker and Hewitt to see nuclear events in the past as retrievable. In a frequently cited passage, Walter Benjamin writes that “articulating the past historically does not mean recognizing ‘the way it really was.’”³⁵ Determining the way it was is an impossibility. There is no single version of the past, he is saying, only multiple versions. In another passage, Benjamin observes that because history tends to break down into images, “there can be no photographic image, no force of arrestment, which does not tell us of the relation between images and history, photography and memory, and space and violence.”³⁶ Photography, history, memory, and violence are part of the same continuum. They cannot be pulled apart. If Sebald and Barthes focused on subjective memories produced by photographs, the sociologist Maurice Halbwachs concentrated on shared memories. He coined the term “collective memory,” suggesting that memory resides in group consciousness more than in individual consciousness.³⁷ Collective memory exists outside the individual; photographs of Hiroshima and Nagasaki are part of a shared consciousness.

This book began as a series of questions. In what ways, I wanted to know, has photography contributed (or not) to an understanding of Canada as a nuclear nation? How has Canada’s engagement with the ongoing nuclear era been visualized? What sort of image, for example, is a US military photograph of Test Grable taken at the Nevada Test Site in 1953, in which Canadian troops were exposed to radiation? [Figure 1.6] In what ways do photographs make the invisible visible? Has photography helped or hindered our comprehension of the nuclear era and nuclear risk? What are its limitations in representing nuclear events? How are the technologies of photography and nuclear fission connected? How do photography and language work together to produce nuclear narratives and construct public memory?

I use these questions to guide the chapters of this book, which are organized as intersecting case studies. In the next chapter, for example, I examine the activities of the nuclear industry and ask if photography can make visible its operations. Robert Del Tredici’s book *At Work in the Fields of the Bomb* is the centrepiece of the chapter. Combining text and image, it traces the intricate links between the nuclear industry’s far-flung activities. Del Tredici’s

| **Figure 1.5:** Page from “Science Tackles Radiation Peril,” *Life*. 1955.



revelations also inform Chapter 2, which focuses on radiological accidents that occurred at the Chalk River nuclear complex and elsewhere, most of which have been minimized by authorities.

Few aspects of the nuclear environment, I argue, have escaped the camera's gaze. The camera possesses the power of deferred sight, the uncanny ability to make seeable what cannot always be seen at the time of an event.³⁸ The nuclear optics of the visible and the invisible are addressed by Akira Mizuta Lippit in *Atomic Light (Shadow Optics)*, which contends that some things will always remain "profoundly unseen."³⁹ Still, the physicist Ernest Rutherford used strips of film in his radiation experiments at Montreal's McGill University in the early 1900s to differentiate between invisible alpha and beta particles, producing research that earned him the Nobel Prize.⁴⁰ He also developed the concept of radioactive half-life, defined as the time it takes for one-half of the radioactive nuclei of a given element to disintegrate. Engineers and miners at Port Radium used film to find uranium by means of radioactive emission, which left its trace on photosensitive surfaces, rendering visible what otherwise could not be seen.⁴¹ The physicist J.H. Webb at Eastman Kodak discovered the existence of atomic fallout as an atmospheric phenomenon when he tracked radiation that had damaged film in contaminated packaging in Indiana back to Alamogordo, New Mexico, the site of the first nuclear test.⁴²

Issues of visibility and invisibility are central to the relationship of photography and nuclear technologies. Albert Einstein's 1905 mass-energy conversion equation, $E^2 = p^2c^2 + m^2c^4$, where "p" is the momentum of the particle, is fundamental not only to nuclear science but also to photography. Because light carries energy, when silver bromide grains in film are struck by light the electric charge of silver shifts to produce indexical images. Photography can provide, as no other technology can provide, quantitative and qualitative documentation on nuclear tests; it is an indispensable means of analyzing the effects of explosions. Photography is "the basic instrument for accurate measurements of movement as a function of time," writes Peter Kuran, director of several documentaries on the nuclear era, expressing himself in language that is strikingly similar to that of Eadweard Muybridge when he described his photographic experiments on motion in the late nineteenth century.⁴³ Muybridge's experiments pointed the way toward motion pictures, notes his biographer Rebecca Solnit: "He is the man who split the second, as dramatic and far-reaching an action as the splitting of the atom."⁴⁴

But there are limits to photography, as I have mentioned. Because the medium focuses on the here-and-now, it is ill-suited for recording the slow destruction caused by radiation. It cannot readily depict changes in the atmosphere or in the human body that occur over years and decades. The temporality of radiation and its effects, Julia Bryan-Wilson notes, take place in a different register than photography.⁴⁵ Photography also privileges certain kinds of information at the expense of others. It helped make the residue of dust and debris that forms the mushroom cloud a dominant image of the atomic age, to the point that it has sometimes

| **Figure 1.6:** US Military. *Photographing Test Grable*. 1953.

eclipsed the threat of the bomb itself. The caption at the bottom of a page torn from a book, kept and stamped by the Toronto Public Library, accompanies a photograph of the Nagasaki mushroom cloud. It states, "The power of the atomic bomb is beyond belief."⁴⁶ That is all. It makes no mention of the death and destruction that occurred below the mushroom cloud or of the invisible fallout dispersed across a region and beyond. Photographs of the mushroom cloud have diverted attention away from the real and present dangers posed by nuclear weapons.⁴⁷

The nuclear photographs in this book range from images released by civil and military authorities, to works by Canadian artists, to the visual ephemera of brochures and postcards. Aesthetic hierarchies of photography matter less than content in my choice of images. Atomic photography is found in advertising, fine art, scientific experiments, journalism, medical procedures, civil defence manuals, corporate reports, family snapshots, and popular culture. In 1966, Imperial Oil published a brochure on nuclear nomenclature in cooperation with Atomic Energy of Canada Limited to emphasize its involvement with nuclear energy. [Figure 1.7] The cover image represents the spent fuel pool of an atomic reactor. When fuel rods are removed from reactors, they are too hot to be moved far and must be placed in cooling pools at least twenty feet deep to protect workers from the radiation being emitted. Taken from directly above the pool, the photo shows symmetrically arranged dark shafts tilting inward.

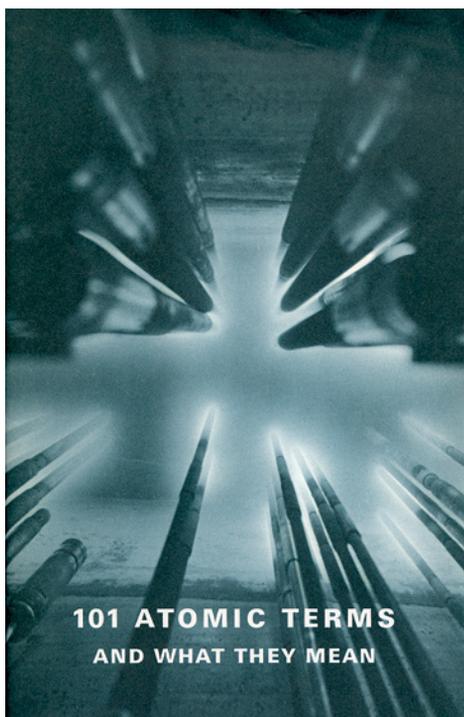


Figure 1.7: Imperial Oil Limited. Cover of *101 Atomic Terms and What They Mean*. 1966.

It is so abstract as to be virtually unreadable. The degree of abstraction aestheticizes the dangers posed by the rods, which are highly radioactive and need to be sequestered in fuel pools for up to ten years.⁴⁸ In the book, I do not reproduce other images as abstract as the cover of the Imperial Oil brochure, but several of them also aestheticize nuclear issues, while purporting to address arms proliferation, radioactive contamination, and environmental risk.

The nuclear shadow that fell across the world following the bombings of Hiroshima and Nagasaki appeared to lift after the Cold War ended in 1989, only to darken again in recent years. The world has now entered a second nuclear age characterized by a growing proliferation of nuclear capabilities, a rising threat of terrorism, and a reconfigured arms race.⁴⁹ Although Canada does not possess nuclear weapons of its own, it remains deeply implicated in global nuclear affairs.⁵⁰ In the absence of photographs and other lens-based

media such as film and video, nuclear phenomena risk being forgotten. I was astonished when the Nuclear Security Summit convened by President Barack Obama in Washington, DC, in early April 2016 faded from public consciousness within weeks, despite dire warnings issued about nuclear terrorists. “If these madmen ever got their hands on a nuclear bomb,” the president declared, “it would change the world.”⁵¹ His warning might have lodged more sharply in the collective consciousness had a video of a drone releasing a dirty bomb – a weapon combining radioactive materials with conventional explosives – not been withheld from public view. The video was screened behind closed doors and seen only by senior political and military figures, some of whom remarked on its horrific content. In the absence of images, the warning did not register strongly in the public sphere.

When he was a boy in the early 1970s, Arctic sovereignty expert Michael Byers watched the contrails of B-52 bombers above his grandfather’s farm in Stoughton, Saskatchewan, as the planes flew north to their advanced staging positions in the Canadian High Arctic.⁵² A decade earlier, Robert McNamara, President John F. Kennedy’s defense secretary, had informed Congress that in addition to the B-52s flying north, nuclear-tipped Bomarc-B missiles were being supplied to Canada. The missiles would function as decoys in the event of a Soviet attack.⁵³ They would draw fire away from the United States and turn Canada into a powder monkey (my description, not McNamara’s). Canada occupied the main geographical zone between the two superpowers of the Soviet Union and the United States. Spatially, it was the filling in a nuclear sandwich.

Until recently, historians have generally portrayed Canada as little more than a condiment in the sandwich. The arms race, they have contended, was a bipolar contest between the United States and the Soviet Union, in which Canada played a bit part. C.P. Stacey, the official historian of the Canadian Army in the Second World War, comments in *Canada and the Age of Conflict* that “there is no space here to tell in detail the story of Canada’s comparatively small involvement in the more-than-epoch-making international drama of atomic energy.”⁵⁴ Canada had no part in the bombs dropped on Japan, he inaccurately declares.⁵⁵

Stacey’s unwillingness to acknowledge Canada’s part in building the bomb contradicts the historical evidence.⁵⁶ His refusal discounts the country’s expertise in nuclear physics and engineering at the end of the Second World War, not to mention its large reserves of uranium, and suggests that had Canada wished to build its own nuclear arsenal it would not have been able to do so. That is incorrect. The atomic complex at Chalk River, Ontario, as part of the Manhattan Project, finished constructing an operational nuclear reactor in August 1945 named the ZEEP (Zero Energy Experimental Pile). A photograph taken from an elevated angle shows a white building housing the ZEEP on the left and a brick building housing the NRX on the right. [Figure 1.8] The Ottawa River, needed to cool the reactors, flows directly behind the buildings. As the first reactor built outside the United States, the ZEEP was intended to produce fissile material for use in bombs, specifically plutonium.⁵⁷ The heavy water concurrently manufactured by Consolidated Mining and Smelting in the West Kootenays – heavy water is used to moderate nuclear fission – was also intended to help



| **Figure 1.8:** *ZEEP and NRX Nuclear Reactor Buildings, Chalk River. 1947.*

produce bombs. The clandestine British Columbia operation, titled Project 9, was guarded by an armoured vehicle called *Seabiscuit*, equipped with four machine guns, which looks as if it were manufactured during the Prohibition era.⁵⁸ [Figure 1.9] A photograph of the Chalk River complex taken by Associated Press, in which the foreground is raked by jagged shadows and the buildings are overhung with heavy clouds, shows employees in trench coats walking down a dirt road. [Figure 1.10] Shot in the slanting light of late afternoon, the image looks noirish, hinting at danger and undisclosed secrets.

In the early 1940s, Canadian scientists played a decisive role in persuading President Franklin D. Roosevelt to mobilize American resources for the purpose of developing a nuclear device, and in the 1950s Canada hosted a delegation from Israel, which had been sent to gather information on how to construct a nuclear reactor of its own.⁵⁹ When Prime Minister David

INTRODUCTION / STILL PHOTOGRAPHS

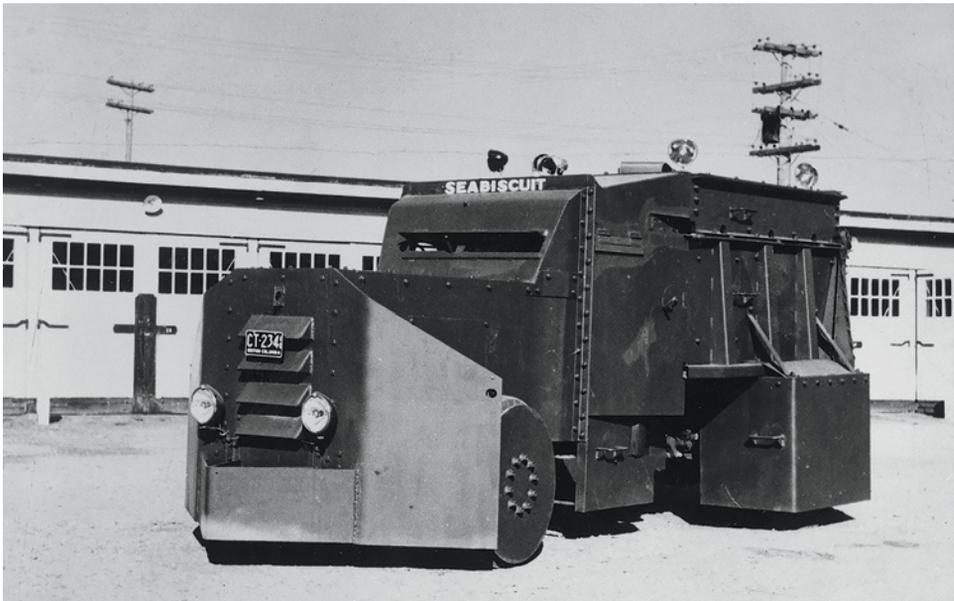


Figure I.9: *Seabiscuit*. c. 1942–45. **Figure I.10:** *ZEEP and NRX Nuclear Reactor Buildings, Chalk River*. 1945.



Ben-Gurion announced to the Knesset in 1960 that Israel was building a reactor, he said it would “be similar to the reactor which the Canadian government helped to construct in India, with the difference that our reactor is of smaller capacity.”⁶⁰ The Dimona reactor in the Negev desert is a near copy of Canada’s second reactor, the NRX. Built for the Israelis by the French to produce plutonium for nuclear weapons, it helped provide Israel with atomic hegemony in the Middle East.⁶¹ Because of its nuclear engineering capabilities and its reserves of uranium ore, Canada was a consequential atomic power at the end of the Second World War. It has remained so.⁶²

At the beginning of the nuclear era, the Soviet Union had no doubts about Canada’s nuclear expertise. On September 5, 1945, a month after the bombings of Hiroshima and Nagasaki, a cipher clerk named Igor Gouzenko, working in the Soviet embassy in Ottawa, defected to Canadian authorities with a stack of incriminating documents revealing the existence of a Soviet atomic spy ring in Ottawa.⁶³ Although Soviet agents were pursuing him, Gouzenko’s request for asylum for himself and his family was almost denied. Prime Minister William Lyon Mackenzie King, with characteristic caution, wished to hand him back to the Soviets to avoid the glare of an international incident. The prime minister was persuaded to do otherwise by his closest advisers, and information from Gouzenko’s interrogation and the 109 documents he brought with him were shared with the United States and Britain. Eighteen months later, the spies, which included Canadian member of Parliament Fred Rose and British nuclear physicist Alan Nunn May, were arrested and jailed. May was sentenced to ten years of hard labour.⁶⁴

Gouzenko’s defection is sometimes said to mark the beginning of the Cold War.⁶⁵ To protect him, Canadian authorities provided him with a new identity and a suburban house in Mississauga, Ontario. There, he wrote an autobiography, *This Was My Choice*, and a best-selling novel about life in the Soviet Union, *The Fall of a Titan*.⁶⁶ In 1954, when his novel was published, Gouzenko began to appear on television and in public wearing a hood. [Figure 1.11] In the first shot of the defector with his head covered, Gouzenko sits in a television studio, “somewhere in Canada” according to the caption, looking as if he is waiting to perform in a horror movie.⁶⁷ The photo is a striking portrait, even if Gouzenko’s face cannot be seen.⁶⁸ The curve of his head echoes the curve of the microphone above him, and although the hands on the clock at upper left are unreadable, we might be justified in thinking they are pointing to midnight.

Gouzenko explained that the hood was to throw Soviet assassins off his scent. It did nothing of the sort, of course, advertising rather than obscuring the wearer and drawing journalists, photographers, and television broadcasters to him. Gouzenko’s decision to hood himself for the photograph is a classic case of antiphrasis – one could say, of atomic antiphrasis – where the presence of the hood conveyed an opposite message to the one being declared. By making

| **Figure 1.11:** International News Photo. *Soviet Defector Igor Gouzenko Wearing a Hood*. 1954.



of himself a spectacle for the camera and marketing his defection, by turning himself into a moving target with a bag on his head, Gouzenko became even more of a celebrity than he already was. He became hypervisible. The defector is remembered more for the hooded photographs than for the books he wrote or the television shows he appeared on. "Photographs (and the little words underneath)," observed the photojournalist W. Eugene Smith, "are molders of opinion."⁶⁹ They stick in the mind as privileged moments that are more easily revisited than texts or moving images. They represent a sliver of stopped time rather than a stream of information that keeps moving. Because they stay still, they are less likely than moving images to be forgotten.⁷⁰ The staying power of photographs is central to my arguments in this book.

The historian Donald Creighton, in *The Story of Canada*, briefly alludes to Eldorado's extraction of uranium at Port Radium in the Arctic, "which made possible the federal government's atomic pile at Chalk River near Ottawa," but like Stacey he neglects to mention Canada's participation in the Manhattan Project.⁷¹ He also neglects to mention that the Sahtu Dene people were involved in carrying the uranium ore.⁷² "Before the mine, you never heard of cancer," hunter and trapper Paul Baton comments, "now lots of people have died of cancer."⁷³ Cindy Gilday, chair of the Deline Uranium Committee, is blunter. She points her finger directly at the nuclear colonialism exercised by Eldorado and the Government of Canada. "In my mind it's a war crime that has been well hidden," she states. "The Dene were the first civilian victims of the war, and are the last to be addressed."⁷⁴ Declassified documents support her assessment – the company and the government withheld crucial health and safety information from the Dene. Some of the Dene ore carriers, as mentioned earlier, slept on the burlap sacks during the long barge journey across Great Bear Lake to the transfer point where the uranium was shipped south and then east for processing.⁷⁵ Because there were so many cancer deaths among the men, Deline became known as "the village of the widows."

Creighton also fails to mention that Canada exported refined uranium ore from Port Hope to the United States for weapons-grade enrichment and use in the Hiroshima bomb as well as in the making of plutonium for the Nagasaki bomb.⁷⁶ Instead, he observes, in an act of painterly displacement, that the Group of Seven depicted the Precambrian Shield in their paintings a quarter of a century before uranium and other minerals were discovered there.⁷⁷ Creighton's decision not to mention the Manhattan Project, the Dene, and Canada's export of uranium to its southern neighbour is like choosing not to mention that before-and-after photographs of Hiroshima look different. [Figs. I.12 and I.13] The contrast can be seen even in postcards. Before the attack, streets are lined with buildings, telephone poles are strung with wires, and streetcars move along tracks. After the attack, there are no buildings, no wires, no tracks.

Creighton's failure to remark on Canada's participation in the production of the atomic bomb, like Stacey's silence on the matter, strikes me as a form of blindness. What is the point of having a field of scholarship called Canadian history, Ian McKay asks, if the real action is so often conceived as happening elsewhere?⁷⁸ Although Creighton's book came out in the middle of the Cold War, it minimized Canada's complicity in the global proliferation of

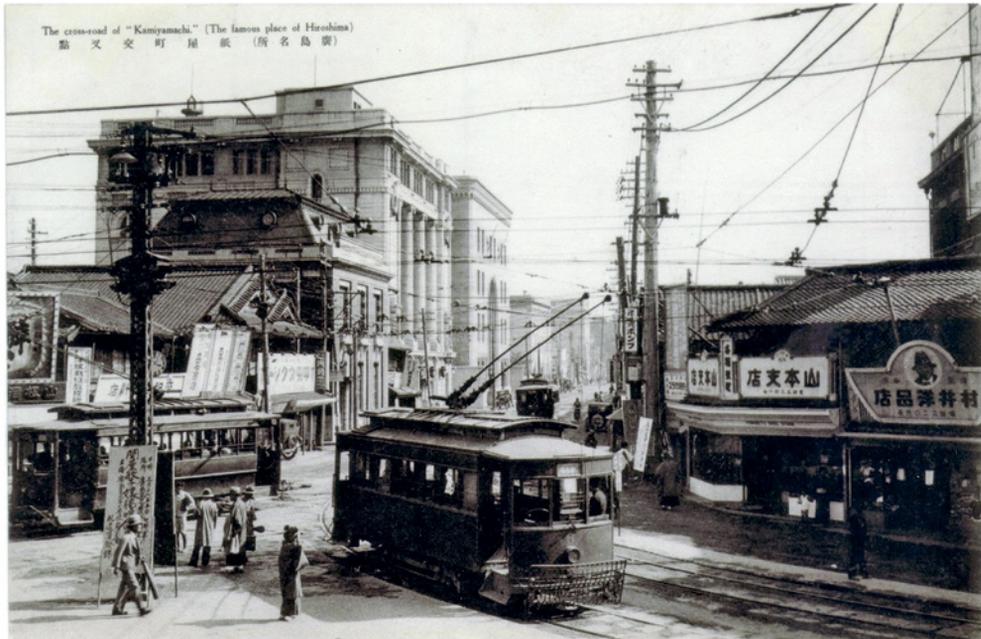
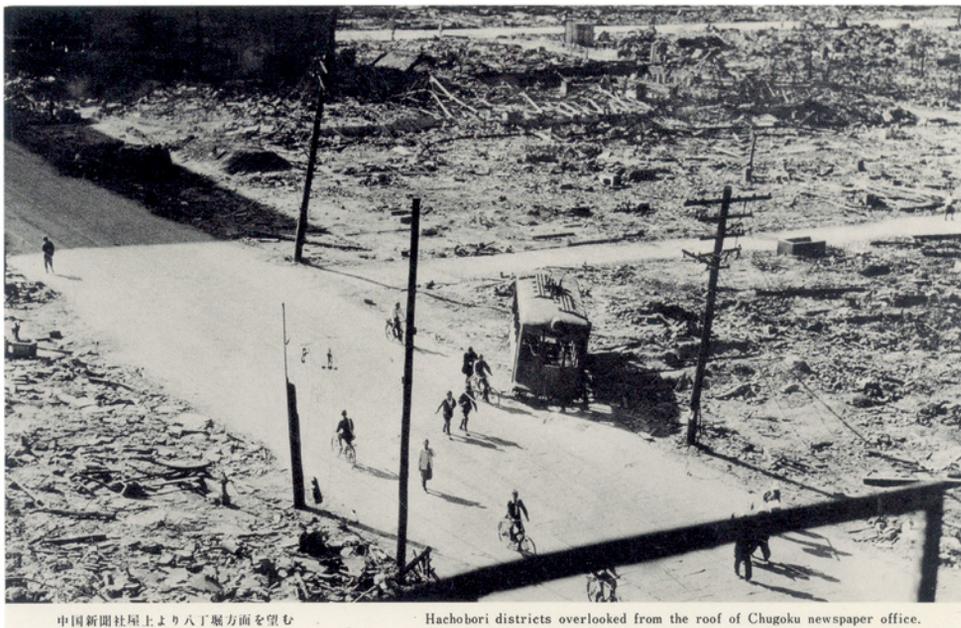


Figure I.12: Postcard. *The Cross-road of "Kamiyamachi" (The Famous Place of Hiroshima)*, c. 1940.

Figure I.13: Postcard. *Hachobori Districts Overlooked from the Roof of the Chugoku Newspaper Office*, 1945.



nuclear weapons. Impressed by Foreign Minister Lester B. Pearson's leadership in organizing the first major peacekeeping mission in the history of the United Nations during the Suez Crisis of 1956–57, for which he was awarded the Nobel Peace Prize, as well as by Canada's role in the UN missions to Congo and Cyprus in 1960 and 1964, Creighton imagined Canada as a nation of peacekeepers, even though it meant masking the country's military commitments and nuclear expertise.⁷⁹ He was not alone in promoting the peacekeeping fiction. Many Canadians romanticized Pearson as an ambassador of peace, conveniently forgetting that he was as much a cold warrior as a peacekeeper.⁸⁰ Nostalgia for Canada's role as peacekeeper has persisted into the twenty-first century, notwithstanding attempts by the Conservative government under Stephen Harper to rebrand the country as a warrior nation of heroes.

After the war, Prime Minister King opted not to pursue a nuclear weapons program, choosing instead to steer a wobbly course between building and banishing the bomb.⁸¹ Canada did not join the nuclear club, whose membership is restricted to nations with atomic weapons, but it did remain a major supplier of uranium to the nuclear programs of the United States and Britain. By the late 1950s, uranium ore was its fourth-largest export after wheat, pulp, and paper. Canada has developed some of the richest uranium mines in the world, including the Gaertner pit at the Key Lake Mine, as seen in Del Tredici's photograph of an immense bucket used for extracting the ore. [Figure I.14] The ore is richest where the earth is blackest, Del Tredici observes. Twelve thousand tons of uranium were produced in 1959, more than by any other nation, most of which went toward the fabrication of nuclear weapons.⁸²

In addition, Canada turned over its coastlines and the adjacent landmass to the United States as proving grounds for nuclear missile and submarine testing; it partnered in the construction of three early warning radar systems, including the Distant Early Warning Line, or DEW Line, to sound the alarm against Soviet attack; it signed the North American Air Defense Agreement (NORAD) in 1958 with the United States, which placed the air forces of the two countries under joint command; it accepted US Bomarc-B missiles with nuclear warheads onto its military bases; and it exported Canadian nuclear expertise around the globe in the form of the CANDU reactor.⁸³ Because the CANDU, short for Canada Deuterium Uranium, is an efficient producer of plutonium, some countries, including India and Pakistan, transformed their reactors, which were intended to generate electric power, into mini bomb factories. Taiwan also developed a nuclear weapons program under the guise of Canada's nuclear-generating exports, but it was terminated in 1988 under pressure from the United States.⁸⁴ Between Prime Minister King's renunciation of Canadian nuclear weapons and his government's assistance in the production of nuclear weapons by others, there lay a radioactive middle ground. Gordon Edwards, founder of the Canadian Coalition for Nuclear Responsibility, concludes that since the Second World War, "Canada has played a major role in fostering the proliferation of nuclear weapons throughout the world."⁸⁵

The chapters in this volume, bookended by a preface and an epilogue, address distinct nuclear themes. They function as intersecting case studies and are organized thematically rather than chronologically. An atomic timeline at the back of the book provides key dates.



Figure I.14: Robert Del Tredici. *Uranium Shovel* (Gaertner Pit, Key Lake Mine, Northern Saskatchewan, Canada). 1986.

This introduction addresses the principal themes as well as providing an initial response to the questions posed earlier. Chapter 1, as mentioned above, concentrates on the nuclear industry and how Robert Del Tredici's 1987 photobook *At Work in the Fields of the Bomb*, which in my opinion sets the standard for such books, helps to make the activities of the industry visible. It shows how the bomb's far-flung component parts – uranium mining and refining, plutonium production, reprocessing, weapons assembly, testing, research and development, reactor design and construction, radioactive waste management – are intricately connected. Chapter 2 examines the nuclear complex at Chalk River and the radiological accidents there and at other sites around the world. It reflects on how photography and what I am inclined to call the “Godzilla effect” – a metaphor for how nuclear technologies have threatened civilization by outrunning the ability of experts to control them – have shaped perceptions of radiation risk. Chapter 3 discusses military and civil defence, especially the ways government leaders, in Canada and elsewhere during the 1950s and 1960s, advised citizens that a nuclear conflict could be defended against while preparing for a war they knew could not be won. With the development and testing of thermonuclear weapons in the early 1950s, more sophisticated and more powerful than the bombs dropped on Hiroshima and Nagasaki, the possibility of surviving an atomic attack became fantasy.

“Cloud Shadows,” Chapter 4, observes that in the Cold War era every part of the globe, including the furthest reaches of Canada, was haunted by the image of the mushroom cloud.

It presented a spectacle of mass destruction, largely through photographs, that made it the dominant icon of the atomic age and its most extravagant figurehead. The spectacle attracted not only producers of popular culture, but also artists who tried to make it strange again. Chapter 5, "Atomic Soldiers," examines discrepancies between official and vernacular memory in the representation of nuclear events. Canadian military personnel were participants in more than two dozen nuclear weapons tests in Nevada, the South Pacific, and Australia from the end of the Second World War until atmospheric testing was discontinued in 1962. In 1957, Operation Plumbbob was the longest and most elaborate series of tests conducted in the continental United States, and it is notorious for the decision by US and Canadian military commanders to use foot soldiers as guinea pigs during operations. The relationship of photography to state power and mass protest is the main concern of Chapter 6. It is ironic that when French secret service agents sank the Greenpeace ship *Rainbow Warrior* in Auckland Harbour in 1985, during a clandestine bombing attack codenamed Opération satanique, the hole ripped in the vessel led to the drowning death of a photographer. The sinking of the ship and the killing of the photographer were a public relations disaster for France. Chapter 7 relates the images of modern and contemporary art photographers to a 1965 book of poems by George Bowering called *The Man in Yellow Boots*. The threat of nuclear war, a recurring theme in the poems, made everyone a bulls-eye. The Epilogue reflects on radioactive waste disposal from the production of atomic weapons and nuclear energy as well as on plans under way to build a new generation of reactors, small modular reactors (SMRs).

Photography shapes the speed and forms of knowledge accessible to nuclear scientists, and the search for scientific knowledge shapes photography. The technologies of photography and nuclear fission are intimately (perhaps even lethally) connected. At the height of the Cold War, Marshall McLuhan noted that the two technologies were responsible for creating social environments in which time speeded up and space was compressed. That was the case for Canada as much as it was for nations in the nuclear club. Photography was producing "a world of accelerated transience," he wrote, and nuclear fission was doing the same.⁸⁶ Photography occupies a pivotal place in the representation and understanding of nuclear weapons and nuclear energy.

© UBC Press 2020

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without prior written permission of the publisher, or, in Canada, in the case of photocopying or other reprographic copying, a licence from Access Copyright, www.accesscopyright.ca.

29 28 27 26 25 24 23 22 21 20 5 4 3 2 1

Printed in Canada on FSC-certified ancient-forest-free paper (100% post-consumer recycled) that is processed chlorine- and acid-free.

Library and Archives Canada Cataloguing in Publication

Title: The bomb in the wilderness : photography and the nuclear era in Canada / John O'Brien.

Names: O'Brien, John, 1944– author.

Description: In title, the “o” appears as a bomb. | Includes bibliographical references and index.

Identifiers: Canadiana (print) 20200262459 | Canadiana (ebook) 20200262599 | ISBN 9780774863889 (soft-cover) | ISBN 9780774863896 (PDF) | ISBN 9780774863902 (EPUB) | ISBN 9780774863919 (Kindle)

Subjects: LCSH: Nuclear weapons—Canada. | LCSH: Nuclear energy—Canada. | LCSH: Photography—Social aspects—Canada.

Classification: LCC U264.5.C3 O27 2020 | DDC 355.8/251190971—dc23

Canada

UBC Press gratefully acknowledges the financial support for our publishing program of the Government of Canada (through the Canada Book Fund), the Canada Council for the Arts, and the British Columbia Arts Council.

This book has been published with the help of a grant from the Canadian Federation for the Humanities and Social Sciences, through the Awards to Scholarly Publications Program, using funds provided by the Social Sciences and Humanities Research Council of Canada.

Printed and bound in Canada by Friesens

Set in Garamond Premier Pro and Jost by Michel Vrana

Copy editor: Deborah Kerr

Proofreader: Alison Strobel

Indexer: Stephen Ullstrom

Interior and cover designer: Michel Vrana

Cover image: Robert Del Tredici, *Stanrock Tailings Wall, Elliot Lake, Ontario*.

The University of British Columbia

2029 West Mall

Vancouver, BC V6T 1Z2

WWW.UBCPRESS.CA