1 Nuclear fallout as risk

Denmark and the thermonuclear revolution

Casper Sylvest

Among the consequences of nuclear fallout in the Cold War West was a new wave of fear concerning everyday existence and the future of human civilisation. This phenomenon attracted attention when large parts of the West also invested hope in a future driven by peaceful atoms. Meanwhile, the superpower politics of the Cold War was precariously poised. In Denmark and elsewhere, the debate on fallout raised questions about political and epistemological authority, which in turn shaped Western societies in the ensuing decades. While these controversies initially concerned the efficacy of civil defence, health effects, and the rationale and risks of nuclear testing, their wider reach gradually became evident. The debate was emblematic of a contentious, complicated struggle over knowledge that reconfigured scientific authority. It involved uncertainty, a dynamic agenda, political interests, and information campaigns. Over time, it shaped popular politics, giving rise to new forms of activism and social movements insistent on transparency and intergenerational justice within an increasingly global vision. In short, fallout constitutes a peculiarly radioactive sort of those “seeds of the sixties” that were dispersed in the 1950s.¹ The debate gave rise to a notion of stewardship that was proto-environmentalist in orientation.² Indeed, the recurrent contemplation of death, destruction, and global risk in the thermonuclear age produced a gaze towards the future that paved the way for many of the questions about modernity addressed in this book, whether they concern limits to growth, new forms of environmental thinking, or new forms of regulation.

Fallout refers to the distribution of radioactive material resulting from a nuclear detonation. Depending on the size of the detonation and its proximity to the earth’s surface, this material may reach the atmosphere or stratosphere, where it will sail in the wind before, eventually, dropping to the ground. While this phenomenon had figured sporadically in popular science before the mid-1950s, it had mainly been the province of scientific and specialised interest. Above all, it was events during the spring of 1954 that ignited the fallout debate. On 15 March, two weeks after the American Castle Bravo test of a thermonuclear device on the Bikini atoll, the Danish newspaper *Politiken* carried a news story on its front page: “Pacific atoll obliterated in new test of a hydrogen weapon”. The story pointed out that 236 local residents and

28 US military personnel were being examined for radioactive poisoning and referred to an official admitting that the size of the test surprised US authorities. The article went on to speculate about a further “gigantic” test planned for 1 April 1954 and illustrated the unfathomable power of H-bombs by referring to their explosive power as the equivalent of 1,000 Hiroshima-sized bombs.³ By late March 1954, Bravo’s contamination of the crew of a Japanese fishing vessel caused a media frenzy and directed attention to fallout. The US government was forced to respond, and the debate had begun.⁴

In this chapter, I examine the Danish debate over fallout by asking how knowledge about the effects of nuclear weapons was created, circulated, and contested. When the question became salient in Denmark, with some delay, a sustained process of information gathering, analysis, and debate was initiated. In the years following the bombings of Hiroshima and Nagasaki, Danish citizens had access to general knowledge and news reporting about the development of nuclear weapons technology, and in that context, it was mainly the sheer force of the bomb and the dangers associated with radiation (through direct exposure) that were highlighted. Fallout, however, was uncharted territory. The phenomenon raised vexed questions for a small state. A history of knowledge perspective represents a particularly productive approach in relation to this topic, as the debate constitutes a quintessentially modern case of assessing scientific knowledge and evaluating risk in a highly politicised context, where secrecy and limited access to information constituted recurrent challenges.⁵ It soon became clear that fallout could be understood through various formal, scientific methods as well as through less formal, more intuitive approaches focused on precaution. Unfolding at a time when the thermonuclear revolution and the prospect of a new, menacing form of warfare dominated by megaton bombs and long-range missiles appeared inevitable and increasingly real, this debate had a series of direct and indirect effects on life and politics in Denmark: from questions of national security, civil defence, and public health to the more elusive existential and emotional challenges associated with life in the nuclear age. Studying the Danish case in a transnational context not only provides insight into a debate straddling elite and popular politics and spanning questions of science, health, and politics. It also demonstrates how a small state dependent on its superpower ally for security and, to a large extent, information about the effects of nuclear weapons received, circulated, and created knowledge at the height of the Cold War.

Against this background, I ask two questions: first, how the debate over fallout was reflected, received, and possibly transformed in Denmark, and what political stakes were involved in this production of knowledge? Second, what kinds of arguments came to prevail, and how were they promoted? I begin by outlining the contours of American (and British) debates on radioactive fallout during a period of nuclear testing and increasing public scepticism towards the arms race and its consequences. I then turn to the Danish debate by examining the circulation and production of knowledge among and by authorities, scientists, and peace activists.

Knowing fallout

Since the late nineteenth century, radiation protection had focused on scientists and professionals working with x-rays and radium. With the invention of the atomic bomb, the question expanded massively. The number of radioactive substances increased, and radiation exposure gradually became a wider concern. The scientific community reacted by becoming more sceptical of the biological consequences of radiation exposure. Terminologically, this shift was symbolised by a shift from “tolerance dose” to “maximum permissible dose”, which “conveyed the idea that no quantity of radiation was certainly safe”.⁶ In a period when fear of atomic weapons was accompanied by atomic utopianism in areas of health, energy provision, and transportation – a vision that was promoted in President Eisenhower’s Atoms for Peace program – the US Atomic Energy Commission (AEC) was tasked with monitoring and protecting the American population from any dangers of radioactivity resulting from nuclear technology. Radiation effects had been a contentious and closely guarded question when the atomic bomb was invented and used in 1945.⁷ The arrival of the H-bomb produced a host of new issues, and the AEC found itself at the centre of the ensuing controversy.

From 1954, the key scientific issues of the fallout debate concerned protection and the consequences for humans of exposure to (low-level) radiation over time. While distinct, these issues were not easy to separate. The main focus was originally on civil defence and human health effects, though prominent voices in the debate also drew attention to the consequences for animals, plant life, and nature more broadly. Initially, local (or regional) fallout took prominence, but in time, global fallout and its consequences for humanity and nature also attracted attention. Three questions were central: first, how could civil defence deal with radioactive fallout; second, did fallout produce somatic injuries (predominantly cancer), or was there a threshold below which fallout did not have harmful effects; third, what if any genetic consequences would follow from an increase in (the global distribution of) fallout? Much of the debate was characterised by conjecture based on incomplete data, and security concerns loomed large. Received wisdom – that radioactivity produced harmful effects – was often repeated, but voices of authority, primarily the AEC and affiliated scientists, preferred to speak of relative risks and (low) probabilities, which informed a permissive approach to weapons development and testing. Critics, primarily scientists and/or activists, stressed the risks by zooming in on uncertainties and cumulative effects, which led to projections of absolute numbers (e.g., numbers of humans born with genetic defects).⁸

The uproar over the H-bomb brought politicians, public figures, and intellectuals to demand the suspension of nuclear testing. Pope Pius XII pointed to fallout when calling for the abolition of nuclear war, and scientists soon highlighted the risks of a rise in radiation levels.⁹ The AEC initially sought to evade these questions. When pressed, the commission, often represented by Dr William Libby, sought to minimise the danger by arguing that health and

other risks of testing were dwarfed by the advantages relating to “the security of the nation and of the free world”.¹⁰ Despite the fact that the US Federal Civil Defense Administration (FCDA) expressed some bewilderment over fallout¹¹ and that prominent intellectuals such as Albert Schweitzer, Albert Einstein, and Bertrand Russell¹² voiced concerns, the AEC appeared to subsume science in Cold War politics. As a result, the commission faced criticism.¹³ Hearings on civil defence and fallout in the US Congress, organised in 1956 and 1959 by Chet Holifield (D-Cal), reinforced this trend.¹⁴ Gradually, the need for more information, more openness, and a precautionary approach to the problem of nuclear testing became a prominent cause. Fallout featured in Adlai Stevenson’s 1956 presidential campaign, it became a central theme of the Pugwash movement,¹⁵ and the National Committee for a Sane Nuclear Policy (SANE) focused directly on fallout and testing through ads in national newspapers. In 1957 and 1958, a petition organised by Linus Pauling was signed by almost 2,000 American scientists and 11,000 scientists worldwide. A signatory to the Russell–Einstein manifesto, Pauling openly criticised the US government, which led to clashes with AEC chairman Strauss as well as with the “father of the H-bomb” and relentless advocate of ever larger weapons, Edward Teller.¹⁶

The scientific issues at the root of the debate were hard to resolve. On the one hand, fallout had become deeply imbricated in Cold War politics, most directly in the test ban politics that played a central role in US–USSR relations during the period. Dissent was frequently exploited by Soviet propaganda, and in both American and British domestic politics, scientific criticism of government positions was at times, subtly or not-so-subtly, associated with fifth-column activity.¹⁷ On the other hand, within the scientific community, theoretical disagreements and a lack of data and research meant that projections and conclusions were subject to disputes. A constant drip of new data and interpretations made consensus virtually impossible. This complexity and the politicisation involved are evident in relation to three landmark reports on the subject.

The first two of these reports, *The Biological Effects of Atomic Radiation* (BEAR), published by the US National Academy of Sciences, and *The Hazards to Man of Nuclear and Allied Radiations*, published by the British Medical Council (MRC), appeared simultaneously in June 1956. A study of their origins has pointed out that the BEAR report was “far from being a detached, independent evaluation”. Rather, it was the result of careful negotiation “not only among scientists, but also with” the AEC and the MRC. The publication of the two reports was closely coordinated, and they reached broadly similar conclusions (even though they followed different approaches). BEAR, this study concludes, helped produce an illusion of scientific consensus that was subsequently exploited by US authorities to “play down the risks of fallout by calling them minute additions to the bath of natural radiation in which humans already lived.”¹⁸ Yet, the reports also fuelled controversy. Despite the conclusion that fallout from existing nuclear weapons tests “did not represent a major health hazard”, the findings of BEAR could be viewed as “deeply disturbing,

especially in their emphasis on the genetic effects of radiation.”¹⁹ The British report dispelled the most dramatic fears about fallout; however, within a year, in the period leading up to the first British hydrogen bomb test, dissenting scientists reactivated concerns by focusing on the role of strontium-90.²⁰ The third report that made an impact was published in August 1958 under the auspices of the UN Committee on the Effects of Atomic Radiation. This report was also subject to differing interpretations rooted in a lack of data and research in specific areas. In its chapter on “Fundamental Radiobiology”, the report stated that despite medical benefits,

the evidence points to the fact that these radiations are harmful and that their effects are frequently cumulative. [. . .] In the light of these considerations there is an imperative need for keeping the radiation level as low as feasible.²¹

Formulations such as these ensured continued debate on the effects of radiation. The report, however, could also be interpreted in ways that stressed the miniscule risks of fallout from nuclear weapons testing.

From the late 1950s until fears of fallout began to recede during the early 1960s, particularly after the signing of the Limited Test Ban Treaty (LTBT) in 1963, this was the context in which anti-nuclear activists and troubled, dissident scientists confronted political authorities and their scientific advisors. The debate was subject to the ebbs and flows of international test ban politics, in which the superpowers reigned supreme. Frantic testing was accompanied by political points-scoring, new proposals, and technical negotiations. A moratorium took hold from late 1958, only for testing to resume in 1961. In these circumstances, the fallout debate constituted a significant step towards the creation of a quintessentially modern language of risk.²² Combining questions of nuclear testing, civil defence, disarmament, and security, it ran together discourses of health, science, and ideology. Fear – of war and of the unknown – was a common reference point. Uncertainty proved endemic, and most conclusions had a provisional quality that opened the door for counterarguments. In the end, therefore, this was a debate about what kinds of risks should be accepted and by whom. These were hazardous waters to navigate for a small state. How dangerous was fallout and what should be done?

Fallout in Denmark

In Danish public debate, questions of fallout and nuclear testing gradually received more attention during the mid-1950s. Scientists like Sven Werner, professor of physics and member of the Danish Atomic Energy Commission (DAEC), mentioned the problem of “nuclear ashes” in 1955.²³ Folketinget, the Danish parliament, debated the issue in both 1956 and 1957. Predictably for a small state excited about the prospect of peaceful atoms,²⁴ however, fallout was subject to the pull of Cold War politics. The government soon insisted that

global fallout from nuclear weapons tests did not constitute a risk.²⁵ Neither did fallout cause the Danish Health Directorate (DHD) much concern.²⁶ If nothing else, however, continued national and international debate and periodical detections of increases in radioactivity at home and abroad meant that apprehension and uncertainty persisted. But what did Danish authorities know and how?

Getting a grasp

Inside the Danish Civil Defence Directorate (DCDD), the scale of the fallout problem and the resulting doubts about the design, rationale even, of civil defence was apparent within weeks of Castle Bravo. During an informal meeting about the H-bomb, the agency discussed a proposal to have NATO's civil defence committee counter the "what's-the-point" attitude now flourishing.²⁷ In the ensuing weeks and months, however, this kneejerk reaction was substituted by genuine attempts to acquire new knowledge and think through the problem. At another informal meeting, DCDD director Arthur Dahl pointed out that there was a need for "clarity (concordance with other countries) about tolerance to radiation."²⁸ A few days later, the directorate decided to terminate its work on a leaflet to the public about atomic war, as the test at Bikini had upended the whole question.²⁹ The failed information campaign is symbolic of the uncertainty and frantic search for information about the H-bomb, fallout, and their implications for civil defence that took hold of the directorate. For Danish officials, these questions were urgent but also well-nigh impossible to resolve without information from abroad.

DCDD followed debates in the United States and the United Kingdom closely. During 1954, the agency on two occasions solicited information from the UK on safe dosages and asked the US government in a NATO meeting to release further information about fallout.³⁰ The surviving archive also demonstrates that a great deal of information was trawled – from AEC statements and scientific work to musings about clean bombs and medication against fallout.³¹ Despite an FCDA statement in October 1954 that made its way to Denmark frankly admitting that "we don't know enough" about fallout,³² Dahl publicly argued that a small rise in radioactivity in Denmark did not derive from nuclear testing and that small doses did not have "any consequences for human health".³³ DCDD was trying to find its feet, and as part of the learning process, Dahl completed a two-volume memorandum on the H-bomb in March 1956, before embarking on a lengthy excursion to the United States. In reaching the conclusion that Danish civil defence was still relevant and required adjustments rather than wholesale reform, the memorandum chiefly relied on information from the AEC and associated scientists.³⁴ The document appears to have been the first step towards the planning assumptions of Danish civil defence that were completed in 1959.³⁵ The main priorities were attacks with conventional weapons or forces in combination with atomic bombs. While the use of H-bombs on Danish territory was seen as possible but unlikely, precautions

against fallout from H-bomb attacks on neighbouring countries were envisaged as an important task.³⁶

However, providing a defence against fallout required knowledge, and DCDD officials are likely to have welcomed the substantial discussions in NATO initiated in 1955.³⁷ While the agency did not at this stage seek to inform the wider public, personnel and volunteers deserved some guidance. In meetings with local civil defence commissions and police, the agency distributed a photocopy of British instructions regarding the hydrogen bomb, and during the spring of 1955, the agency also notified local organisations that a translation of the AEC report on fallout from February 1955 was in preparation.³⁸ This was necessary since fallout had not, for example, made its way to the volunteer organisation Civilforsvars-Forbundet: educational material produced in 1955 was silent about the phenomenon and solely referred to atom (fission) bombs.³⁹ By now, however, the scientific debate on the properties and risks of fallout was about to expand, and Danish scientists did not see eye to eye.

Scientific debate and popular politics

The scientific debate about fallout in Denmark was dominated by two opposing standpoints. A group of scientists, predominantly geneticists and biologists, developed a sceptical and precautionary approach to fallout. A prominent member of this group was Mogens Westergaard (1912–1975), professor at the University of Copenhagen and a geneticist specialising in chromosome development in plants. In 1955, the year he was elected to the Danish Royal Academy of Sciences, Westergaard published an article titled, “Man’s Responsibility to His Genetic Heritage”. This article first appeared under the auspices of UNESCO’s review *Impact of Science on Society* and was subsequently reprinted in *The Bulletin of Atomic Scientists*. Alongside a controversial paper by prominent geneticist and Nobel Laureate H.J. Muller,⁴⁰ Westergaard presented the gene-chromosome theory, from which he derived a “gene ethics”. This ethics recognised that many people were increasingly “extending their sense of responsibility to include the whole species”, and it stressed the necessity of avoiding “all unnecessary irradiation of our genes and chromosomes” as the potential damage from such exposure would be irreparable and would only become apparent in the course of generations.⁴¹ Westergaard also commented on the specific dangers of the atomic age, including civilian and military uses of atomic energy. He clearly advocated a precautionary approach. Most geneticists would, Westergaard argued, be sceptical regarding continued nuclear weapons testing, since it involved “a continued exposure of a large part of the world’s population to incalculable genetic risks.”⁴²

In the ensuing years, Westergaard restated these views and contrasted them to those of physicists. Libby, a physical chemist, was the most prominent figure, but Westergaard implied that the problem ran deeper. By 1957, he had reached the conclusion that fallout was an ethical and not a scientific issue. Qualitatively, everyone now agreed that an increase in radiation was undesirable, but in the

quantitative analysis that informed decisions on effect and danger, scientists differed because they went beyond science. The subtext was clear: in contrast to physicists, geneticists operated on a vast timescale of generations, and Westergaard felt confident in arguing that nuclear testing in the mid-twentieth century would, in time, cause genetic mutations and an increase in cases of leukaemia. The opposing side, often linked to political authorities, treated the problem as discrete, bounded in time and space. In addition, they often argued for a continuation of nuclear tests, as these were morally and politically necessary.⁴³ Westergaard's position was shared by several Danish scientists. They voiced their concerns in newspapers, radio talks, and in *Perspektiv* – a Danish publication on literature, art, and science established in 1953, frequently publishing articles on the nuclear age.⁴⁴ The group included Øyvind Winge, the first Danish professor of genetics;⁴⁵ Tage Kemp, director of a Rockefeller-sponsored centre for human genetics and eugenics at the University of Copenhagen and member of DAEC;⁴⁶ and H.V. Brøndsted, a biologist who in 1956 sought to popularise and deliberately dramatise the scientific case for precaution in his book *The Atomic Age and Our Biological Future*.⁴⁷ It was characteristic of this group that they lamented both the secrecy surrounding fallout information and the political inclination of scientists (too) close to governments, that they were worried about the consequences of gradually accumulating fallout, and that they referred to statements and activities by public intellectuals and dissident scientists from abroad.⁴⁸

Pitted against this precautionary position was a more permissive interpretation of fallout tied to Cold War politics, represented above all by Professor Poul Brandt Rehberg. Despite his background in zoology and physiology, Rehberg came to direct scientific research into civil defence questions⁴⁹ before becoming closely associated with wider Danish security and defence policy matters towards the end of the 1950s. As his influence grew, Rehberg's politics increasingly aligned with establishment views. In a 1955 article in *Perspektiv*, he contrasted the opposing perspectives of J.R. Oppenheimer and Edward Teller on the H-bomb. Rehberg criticised Oppenheimer's moral opposition to the new weapon and his naivety in politics. Instead, he sided with Teller, who "one to a large extent must thank, baroque as it may sound, for the détente that is currently taking place."⁵⁰ During the same period, Rehberg contributed to DCDD's early analysis of fallout and played down the risk from testing by relying heavily on AEC information.⁵¹ Alert to the devastation a nuclear war would entail and a fervent believer in a world federation, Rehberg grew into an "intellectual Cold Warrior", who defended deterrence and represented an orthodox NATO position in Danish public debate.⁵² He was convinced that nuclear weapons and the balance of terror were beneficial not only for Denmark but for the world at large, given the state of the Cold War. This perspective seems to have played a role in his approach to testing and fallout.

Particularly during 1957 and 1958, Rehberg developed a permissive interpretation of fallout that brought him into conflict with the geneticists. In May 1957, he argued in the *Politiken* newspaper that while nuclear war would

likely destroy civilisation, the nuclear tests that had been conducted did not present a significant hazard.⁵³ Both Kemp and Westergaard issued swift responses. Kemp maintained that it was wrong to present nuclear tests as harmless and argued that fallout could cause “cancer, malign blood disease and mutations that can entail serious suffering for future generations”. In his reply, Rehberg questioned Kemp’s motives and argued, referring to the British MRC report, that the risk of genetic effects was miniscule. While somatic effects were difficult to assess, Rehberg insisted that the question should be approached quantitatively in order to avert “unnecessary panic”. Westergaard entered the fray the following day. He was incensed by the “animal physiologist” Rehberg’s attempt to associate Kemp’s precautionary approach with communism rather than the warnings of Albert Schweitzer or the Japanese government. Westergaard also identified a dynamic characterising permissive approaches to the problem: dismissal in confident language was promptly followed by new data, new uncertainties, and new problems.

Rehberg, however, stuck to his guns, arguing that when the new radiation created by testing amounted to less than 1 per cent of natural radiation, the latter “must be far more dangerous”.⁵⁴ In conclusion, he reflected upon the relationship between science and politics, but in doing so, he appeared blind to the political nature of his own position. Rehberg shared “the ethical dislike of the bombs”, but he was opposed to “the conflation of ethically grounded, politically grounded and scientifically flavoured propaganda that is used. A propaganda that creates panic and which I find indefensible to take part in.”⁵⁵ Rehberg’s own line, however, appeared no less political: he stressed the political (i.e., deterrent) function of civil defence and argued that action was preferable to inaction and vague notions of neutrality. On the specific question of the health effects of fallout, Rehberg repeated the position of the American AEC. This line of argument seems to have reached its culmination in July 1957, when Rehberg was reported to have argued in a public talk that the call for a test ban was a “global Communist campaign” based on “unbelievable exaggerations” and that testing could safely continue for another two years before they “had to be stopped”.⁵⁶

Rehberg subsequently toned down this rhetoric, but he did not become an alarmist. While clearly recognising the horror of thermonuclear war, he insisted not only that the prospect made war nearly impossible but also that, should it happen, precautionary measures against fallout – like evacuation and shelters – meant that the worst-case scenario for those warned in time was not necessarily death. Some aspects of civil defence were challenged by the H-bomb, but not its core rationale. If sheltered in a basement for some days following the detonation of 1 MT bomb at a distance of 100 kilometre, a person would likely not feel anything; “at worst you will feel a little sick”.⁵⁷ Rehberg’s interpretation of the 1958 UN report, broadcast on radio for the benefit of Danish citizens, began by emphasising natural radiation and the positive, civilian applications of atomic energy. While he did concede that knowledge about genetic and somatic effects of increased radiation from nuclear testing was incomplete, he cautioned against

exaggerating the dangers associated with fallout.⁵⁸ Once again, he referred to the 1956 BEAR and MRC reports – studies that clearly bore the hallmarks of the official line on the subject. In fact, Rehberg maintained that little was new in the UN report and that the question of continued nuclear testing was less of a biological question than a political and moral one.⁵⁹ It is ironic that Rehberg and Westergaard agreed on this specific point but came to such strikingly different conclusions. For Rehberg as for Libby, the tests could (or had to) continue; for Westergaard as for Pauling, they ought to be stopped before they jeopardised the future of humanity. As it turned out, science, politics, and ethics were hard to separate in the fallout debate.

Given the open disagreement among Danish scientists, it is hardly surprising that fallout became a central focus for radicals and the Danish peace movement. While the scientific debate was less intense after 1958, questions regarding fallout and civil defence as well as broader concerns about the human condition in the nuclear age became more salient in popular politics. This was evident on the Danish left and within the peace movement well before 1960, when *Kampagnen mod Atomvåben* (KMA), a protest movement modelled on the British *Campaign for Nuclear Disarmament* (CND), was established.⁶⁰ Throughout the late 1950s, the leftist journal *Dialog*, at this time suspended somewhere between unreformed Soviet communism and New Left thinking, published several articles related to fallout and civil defence.⁶¹ At the same time, international developments, above all Albert Schweitzer's appeal and a Norwegian study on radioactivity, led Aksel Larsen – the politician who later broke with the Communist Party to establish the Socialist People's Party – to take an interest in nuclear testing and fallout. In May 1957, we raised the issue inside the Communist Party, which was split on the issue, and he debated the questions in the parliament in June of that year.⁶² Finally, peace organisations like Aldrig Mere Krig (AmK) and Komiteen for oplysning om atomfaren (KOA) began publishing material on fallout, strontium, and caesium.⁶³ In this discourse, questions of nuclear testing, nuclear war, civil defence, and life in the nuclear age more generally ran together. When KMA marched into full swing in the early 1960s, based on its young leader Carl Scharnberg's links with AmK and KOA, it was hardly surprising that one of its four key demands was that "the Danish population must receive reliable information on the scale and effects of radioactive fallout".⁶⁴

Official fallout

During the late 1950s, the continued uncertainty about fallout and the politically sensitive nature of nuclear weapons landed Danish civil defence policy in something of a predicament. An attempt to inform the Danish population about the effects of nuclear war in 1958 was frustrated by the parliament. The information was subsequently reprinted in some newspapers, but fallout was only mentioned in general terms; it was pointed out that fallout cannot be heard, smelled, tasted, or felt and that it was dangerous to inhale. Citizens were

asked to take shelter until an area was cleared, something that could take several days.⁶⁵ With public attention mounting, this was never going to satisfy demands. Nor did the failed campaign, which included the recommendation not to be present at the place of a detonation, inspire much confidence in the efficacy of Danish civil defence policy more generally. A key part of the problem lay in the fact that it was impossible to design a credible civil defence against fallout without having reached a conclusion about the properties and dangers of this phenomenon.

DCDD did not relent, however. In its quest, the agency no longer relied primarily on Rehberg.⁶⁶ Instead, the agency ramped up its internal efforts by creating what became known as the “fallout trio”, which seems to have been established during 1957.⁶⁷ It consisted of Schultz, the administrative head of DCDD, Head of Section V. Sørensen, and the scientist J. Ambrosen, a new consultant on radiological questions. Ambrosen was well-suited for the job. He had published on atomic energy since the mid-1940s,⁶⁸ and through his employment at a radiation lab at the University of Copenhagen and his association with the Danish Defence Research Board, he had monitored fallout starting in the mid-1950s.⁶⁹ Though he was not a prominent public figure, it seems as if Ambrosen was well-respected by his peers. In 1959, he participated in a DCDD fallout study trip to the UK, and he appears to have been instrumental in bringing DCDD closer to a policy on fallout. In articles from the period, he charted a course between Rehberg and the geneticists. Fallout was approached as a serious challenge and there was no attempt to ignore the differences of opinion among scientists. With respect to global fallout and strontium-90, Ambrosen unequivocally described this is a problem that had to be monitored closely given the scale of nuclear testing during the late 1950s. On civil defence policy, however, he directed attention to precautionary steps and decontamination efforts and largely followed Rehberg in describing efforts to specify threshold and safety levels.⁷⁰

By 1960, DCDD was making progress on the question of protection against radioactive fallout. An apparently unclassified memorandum went further than any previous DCDD statement. While the document quickly dispensed with the controversial question of global fallout as being outside its remit,⁷¹ it constituted an attempt to formulate a policy based on the 1959 planning assumptions. The memorandum explicitly discussed thresholds and confronted thorny, practical questions, such as how the authorities and the sheltered should deal with contaminated citizens or the exact point in time when sheltered people could remerge into the open. The latter was a question of “weighing risks”, specifically the psychological state of sheltered citizens and “defensible” levels of contamination (since they were unlikely to be completely safe).⁷² In debating the memorandum with the Civil Defence Council, Director Dahl readily admitted that previous attempts had “evaded the problems.”⁷³ Significantly, DCDD based their knowledge almost exclusively on publications by foreign governments (predominantly the United States but also the United Kingdom and the Nordic countries). The guidelines were hardly fail-safe: citizens using public shelters

were supposed to bring their own food supplies for two days, and a great deal of decontamination advice was based on water and soap dispersing radioactive fallout.⁷⁴ The memorandum was subsequently approved by the Ministry of the Interior and served as a further planning tool.⁷⁵

By this time, KMA was exerting political pressure. The campaign published speeches and other material critical of (the lack of) public information.⁷⁶ Moreover, it explicitly recommended publications that were either authored by sceptics or contained discussions of fallout that were critical of statements by American, British, or Danish authorities. These included the fairly sanguine *Atomfaren* (1961) and Geertsen's much more critical *Radioaktivitet* (1961).⁷⁷ Later, the campaign was behind the early publication of some of the scientific conclusions submitted to *Atomoplysningsudvalget* – a committee formed in response to a petition to the Danish government in December 1960 signed by 297 Danish scientists – in which the uncertainties of the estimated damage to human beings were highlighted.⁷⁸

During 1961, however, Danish authorities had reached an understanding of fallout that made it possible to inform the public, something DCDD also found long overdue. At the same time, NATO was pushing for public information on civil defence.⁷⁹ Concern about fallout had by now filtered into mainstream public discourse.⁸⁰ In November, the Minister of the Interior conceded in parliament that Danish civil defence was not sufficiently capable in this respect.⁸¹ The efforts of the authorities culminated with the publication of *Hvis Krigen Kommer* [If the War Comes] in January 1962, a leaflet produced and issued under the auspices of the Prime Minister's Office. Emphasis was on fallout and shelter construction. Hardly satisfied, KMA soon distributed a rival leaflet that took on a much more despondent tone, referring especially to human misery and environmental degradation.⁸² Prior to the national distribution of *Hvis Krigen Kommer*, the Danish Government Film Office and Civilforsvars-Forbundet co-produced a documentary on fallout that supplemented the clear-blue state-sanctioned leaflet. *Radioactive Fallout* was shown on television in early December 1961 and a short version was screened in cinemas across the country.⁸³ As a visual companion to the leaflet, the film unequivocally pointed to the new danger of nuclear war. Indeed, the scenario unfolding in the long version of the film revolved around fallout reaching Denmark following an H-bomb attack on the German city of Kiel. A defiant optimism characteristic of civil defence information blended uneasily with a harrowing depiction of life in a world contaminated by radioactivity.

The film reflected scientific discourse and debate: it introduced different kinds of radiation and in simple terms explained the existence of radioactive particles in the atmosphere as a result of nuclear weapons' use and testing before going on to illustrate how radiation altered chemical bonds in the human body by killing off cells. This could be dangerous, especially if the radiation was strong or if radioactive material entered the body through food or respiration. Significantly, the film explicitly operated with explicit thresholds: a dose of more than 400 roentgens would be very dangerous, and, as the film vividly

made clear, a dose above 600 roentgens would almost certainly mean a painful death. In the face of these dark prospects, the film contemplated a central question: is protection possible? The resounding answer was yes: something could be done if citizens were informed and focused. A mantra of civil defence – “to be prepared can only be positive” – was impressed upon the viewer. Both distance and time were important factors for survival, and shelters were effective means of protection, especially if they were constructed according to government guidelines and reduced radiation to 1 per cent. The film concluded with a stirring yet distressing conclusion:

Civil defence is working to achieve the best possible protection of the population. This is an area where the future will be challenging. Not just for CD but for everyone. Every single person must take an interest in this question. It is a matter of life and death.

The thermonuclear revolution had shaken the foundations of civil defence, but the core idea survived. In educating for civil defence, individual action had become more central. Other themes in the fallout debate – testing and arms racing – were, for now, left unresolved. These problems presented grave risks, but they appeared beyond the reach of a small state precariously placed in a superpower conflict. Apprehension mounted in the wake of the fallout debate, but Danish Cold War security policy remained intact.

Conclusion: tracing fallout

In this chapter, I have traced the Danish debate on radioactive fallout as it unfolded in the late 1950s and early 1960s. The central questions I have pursued are inspired by scholarship in the history of knowledge. They concern the development of the fallout debate as well as its circulation and transformation in Denmark. It has been an additional ambition to unearth the political character of the Danish debate and to identify the arguments that prevailed and the way in which they were promoted. To a striking extent, the Danish debate structurally mirrored international, and especially American and British, developments. Above all, the fallout debate in Denmark was dominated by two opposing scientific positions: a precautionary approach represented by geneticists and a more permissive approach represented above all by Rehberg. In time, the disagreements among scientists both at home and abroad were significant for mobilising public interest in fallout. Especially KMA's emotionally charged campaign against nuclear weapons (testing) and for more information on the subject was discursively modelled on uncertainty and the long-term risks posited by geneticists. For Danish civil defence authorities, a depoliticised approach eventually took prominence; it was based on a quest for difficult-to-obtain information and less focused on the long-term health effects of global fallout. When information about nuclear war and fallout was finally provided to every Danish citizen in early 1962, it reflected this moderate civil defence

approach. Still, it was anything but satisfactory to activists in KMA. Fallout remained a source of contention.

From the mid-1960s, however, questions about fallout came to occupy a less prominent place in Danish political discourse. The 1963 LTBT brought testing underground but also took the sting out of the anti-nuclear movement.⁸⁴ The treaty constituted an admission on the part of the superpowers of the dangers of fallout from testing, yet it also reflected a political interest of nuclear weapons states to maintain their status. The treaty can be seen as an early effort in environmental protection, but it did not end the arms race or remove the spectre of nuclear war. As a small and largely compliant ally of a superpower that gradually realized the dangers of fallout and continued atmospheric nuclear testing, Denmark passively witnessed the emergence of a new constellation of security, environmental, and health policies. Danish authorities and the established parties of the centre ground had little appetite for discussing nuclear weapons matters openly. During this period, dictates of geopolitics often clashed with the instinctive appeal of a precautionary principle professed by a large number of scientists, intellectuals, and activists. When the latter approach won out in a diluted form with the LTBT, it did so without much fanfare on behalf of its Danish protagonists. The Danish state soon accepted the new political reality as well as the knowledge production and risks assessments underpinning it. The arms race continued, of course, but public scrutiny took on a different and less urgent character. In the ensuing years, however, that most invisible and intangible phenomenon of fallout became a mainstay of the nuclear imagination. The boundlessness and desolation associated with fallout shaped popular politics in the early 1960s. These dystopian qualities returned during the heated debates of the late 1970s and early 1980s, when Denmark rejected civilian nuclear energy and when nuclear disarmament once again became a popular cause.

Notes

- 1 Andrew Jamison and Ron Eyerman, *Seeds of the Sixties* (Berkeley: University of California Press, 1994).
- 2 On these links in the United States, see Joseph P. Masco, "Bad Weather: On Planetary Crisis", *Social Studies of Science* 40, no. 1 (2010): 7–40; Emory J. Jessee, *Radiation Ecologies: Bombs, Bodies and Environment During the Atmospheric Nuclear Testing Period, 1942–1965* (PhD diss., Montana State University, 2013).
- 3 *Politiken*, 15 March 1954, 1–2.
- 4 Robert A. Divine, *Blowing on the Wind: The Nuclear Test Ban Debate, 1954–1960* (Oxford: Oxford University Press, 1978).
- 5 See Johan Östling, Erling Sandmo, David Larsson Heidenblad, Anna Nilsson Hammar, and Kari H. Nordberg, eds., *Circulation of Knowledge: Explorations in the History of Knowledge* (Lund: Nordic Academic Press, 2018); Simone Lässig, "The History of Knowledge and the Expansion of the Historical Research Agenda", *Bulletin of the German Historical Institute* 59 (2016): 29–58.
- 6 J. Samuel Walker, *Permissible Dose: A History of Radiation Protection in the Twentieth Century* (Berkeley: University of California Press, 2000), 11.
- 7 Janet Farrell Brodie, "Radiation Secrecy and Censorship After Hiroshima and Nagasaki", *Journal of Social History* 48, no. 4 (2015): 842–864.

- 8 See also Angela N.H. Creager, "Radiation, Cancer, and Mutation in the Atomic Age", *Historical Studies in the Natural Sciences* 45, no. 1 (2015): 14–48.
- 9 Ralph Lapp played a crucial role in the American debate. In the UK, Joseph Rotblat, the only scientist to resign from the Manhattan project on moral grounds, was a key figure.
- 10 A Report by United States Atomic Energy Commission on Effect of High-Yield Nuclear Explosions, Appendix 7, *Eighteenth Semiannual Report of the Atomic Energy Commission July 1955* (Washington, DC: Government Printing Office, 1955), 147–154 (on 154); Divine, *Blowing on the Wind*, Ch. 1.
- 11 *US News & World Report*, 8 April 1955, 72–78, 126–131.
- 12 Albert Schweitzer, "The Problem of Peace", Nobel Lecture (4 November 1954), accessed 24 November 2018, www.nobelprize.org/nobel_prizes/peace/laureates/1952/schweitzer-lecture.html; "The Russell-Einstein Manifesto" (9 July 1955), accessed 24 November 2018, <http://pugwash.org/1955/07/09/london-launch-of-the-russell-einstein-manifesto/>.
- 13 See also Spencer Weart, *The Rise of Nuclear Fear* (Cambridge: Harvard University Press, 2012).
- 14 See, for instance, Mary M. Simpson, "A Long Hard Look at Civil Defense", *Bulletin of Atomic Scientists* 12, no. 9 (1956): 343–348.
- 15 See Alison Kraft, Holger Nehring, and Carola Sachse, "The Pugwash Conferences and the Global Cold War", *Journal of Cold War Studies* 20, no. 1 (2018). See also Audra Wolfe, *Freedom's Laboratory: The Cold War Struggle for the Soul of Science* (Baltimore: Johns Hopkins University Press, 2018), Ch. 6.
- 16 Paul Rubinson, "'Crucified on a Cross of Atoms': Scientists, Politics, and the Test Ban Treaty", *Diplomatic History* 35, no. 2 (2011): 283–319.
- 17 Divine, *Blowing on the Wind*; Christopher Laucht, "Scientists, the Public, the State and the Debate Over the Environmental and Human Health Effects in Britain, 1950–1958", *The Historical Journal* 59, no. 1 (2016): 221–251.
- 18 Jacob Darwin Hamblin, "A Dispassionate and Objective Effort: Negotiating the First Study on the Biological Effects of Atomic Radiation", *Journal of the History of Biology* 40 (2007): 147–177 (on 175–176); Laucht, "Scientists, the Public, the State".
- 19 Walker, *Permissible Dose*, 21.
- 20 Atomic Scientists' Association, "Strontium hazards", *Bulletin of Atomic Scientists* 13, no. 6 (1957): 202–203; Alison Kraft, "Dissenting Scientists in Early Cold War Britain: The Fallout Controversy and the Origins of Pugwash, 1954–1957", *Journal of Cold War Studies* 20, no. 1 (2018): 58–100; Laucht, "Scientists, the Public, the State".
- 21 General Assembly, "Report of the United Nations Scientific Committee on the Effects of Atomic Radiation", General Assembly, A/3838, 1958, 21. See also Norman Cousins, "Beyond the Beginning", *Saturday Review of Literature*, 6 September 1958, 24–25.
- 22 Toshihiro Higuchi, "Atmospheric Nuclear Weapons Testing and the Debate on Risk Knowledge in Cold War America, 1945–1963", in *Environmental Histories of the Cold War*, eds. John R. McNeill and Corinna R. Unger (Cambridge: Cambridge University Press, 2013), 301–322.
- 23 Sven Werner, "Atomenergien", *Perspektiv* 2, no. 6 (1955): 19–25.
- 24 On Atoms for Peace, see Henry Nielsen and Henrik Knudsen, "The Troublesome Life of Peaceful Atoms in Denmark", *History and Technology* 26, no. 2 (2010): 91–118.
- 25 Klaus Jørgensen, *Atomvåbnenes rolle i dansk politik* (Odense: Odense Universitetsforlag, 1973), Ch. 4.
- 26 "Ingen grund til stråle-panik", *Dagens Nyheder*, 9 March 1957. DHD's chief medical consultant on radiation, Børge Christensen, mainly relied on American information. See also Sundhedsstyrelsen, Journalsager, 1806–1981, 1956/70/23, Danish National Archives (hereafter DNA).
- 27 "Kortfattet referat af møde hos direktøren den 27. april 1954 kl. 14.00 angående brint-bomben og civilforsvaret", Beredskabsstyrelsen, Civilforsvarsdirektør E. Schultz' embedsarkiv (hereafter ES), A- og B-bombeproblemer, 1945–1961, box 1, DNA.

- 28 "Dahl's Notes Prior to a Meeting on 18 May 1954", ES, A- og B-bombeproblemer, 1945–1961, box 1, DNA, 17 May 1954.
- 29 Casper Sylvest, "Atomfrygten og civilforsvaret", *Temp – tidsskrift for historie* 16 (2018): 16–39 (on 29).
- 30 "Kortfattet referat" and "Notater fra samtale med dr. Taylor, A.E.R.E", ES, A- og B-bombeproblemer, 1945–1961, box 1, DNA; Civilforsvarsstyrelsen, *Memorandum om de nucleare våbens indflydelse på civilforsvarets planlægning* (Copenhagen: Civilforsvarsstyrelsen, March 1956), Appendix 2, ES, Memoranda, 1949–1980, box 185, DNA.
- 31 See particularly ES, A og B bombeproblemer, 1945–1961, box 1, DNA.
- 32 FCDA, "Radioactive Fall-Out", ES, A- og B-bombeproblemer, 1945–1961, box 1, DNA, 15 October 1954, 3.
- 33 Arthur Dahl interview [October 1954, no specific date provided], ES, A og B bombe-problemer, 1945–1961, box 1, DNA.
- 34 Civilforsvarsstyrelsen, *Memorandum* (1956).
- 35 On the origins and contents of the assumption, see "Note for the Minister of the Interior on Preparing a Statement on the Parliamentary Debate Requested by the Danish Socialist People's Party", ES, Memoranda, 1953–1958, box 186, DNA, 6 February 1962.
- 36 For a discussion on these assumptions and Danish civil defence policy in the context of NATO debates, see Iben Bjørnsson, "'Stands tillob til panik' – civilforsvarspjecer som befolkningskontrol" (forthcoming).
- 37 For early NATO reports on fallout, see "The Problem of Fall-Out", 28 May 1955 (AC/23(CD)D/106) and 8 September 1955 (AC/23(CD)D/114), NATO Archives Online, Civil Protection Committee (1952–1970), accessed 23 November 2018, <http://archives.nato.int/civil-protection-committee>.
- 38 "Civilforsvarsstyrelsens cirkulærskrivelse af 18. april 1955", in *Love og bestemmelser om civilforsvaret, 1939–1956*, ed. Civilforsvarsstyrelsen (Copenhagen: J.H. Schultz, 1957), 323–327. The translation appeared in *Orientering fra Civilforsvarsstyrelsen* 4 (July 1955): 1–8.
- 39 Civilforsvars-Forbundet, *Angrebs- og Forsvarsmidler*, 3rd edition (Copenhagen, 1955).
- 40 H.J. Muller, "How Radiation Changes the Genetic Constitution", *Bulletin of the Atomic Scientists* 11, no. 9 (1955): 329–338, 352. Muller's career is testament to the complex relationship between science, politics, and ideology in the United States at the time. See Wolfe, *Freedom's Laboratory*, esp. 19, 28–30, 96–97.
- 41 Mogens Westergaard, "Man's Responsibility to His Genetic Heritage", *Bulletin of Atomic Scientists* 11, no. 9 (1955): 318–328, 352 (quoted from 322, 352).
- 42 Ibid., 352.
- 43 Mogens Westergaard, "Atomtidens Risiko [October 1957]" in *Radioaktivitet*, ed. Uffe Geertsen (Copenhagen: Borgen, 1961), 124–121.
- 44 *Perspektiv* was an elitist publication with a circulation of 3,000–4,000. From 1956, it received CIA funding channelled through *Selskabet for frihed og kultur* (SFK) and later from the Congress for Cultural Freedom (CFF), which SFK was affiliated with. Ingeborg Phillipsen, "Selskabet for frihed og kultur", *Kritik* 35, no. 158 (2001): 38–51. On American efforts in the cultural Cold War, see Frances Stonor Saunders, *Who Paid the Piper? The CIA and the Cultural Cold War* (London: Granta, 1999).
- 45 Øywind Winge, "Røntgenstråler og Radioaktivitet", *Perspektiv* 3, no. 1 (1955): 22–25.
- 46 Tage Kemp, "Prøvebombning og radioaktivt nedfald – som politisk og videnskabeligt problem", *Perspektiv* 5, no. 3 (1957): 11–17.
- 47 H.V. Brøndsted, *Atomalderen og vor biologiske fremtid* (Copenhagen: Hans Reitzel, 1956), esp. 11, 68, 82.
- 48 For instance, Winge, "Røntgenstråler"; Kemp, "Prøvebombning", 15; H.V. Brøndsted, "Atomkrigen", *Perspektiv* 8, no. 5 (1961): 27–31; H.V. Brøndsted, "Menneskets biologiske fremtid", *Civilforsvarsbladet* 12, no. 10 (1961): 240–243.
- 49 "Professor Bohrs medarbejdere er gået fra civilforsvaret", *Information*, 31 March 1954, 1, 8; "Brintbomben og vort civilforsvar", *Information*, 2 April 1954, 3, 7.

- 50 Poul Brandt Rehberg, "Striden om brintbomben", *Perspektiv* 3, no. 2 (1955): 5–8 (on 8).
- 51 Civilforsvarsstyrelsen, *Memorandum* (1956), Appendix 8A.
- 52 Henrik Knudsen, *Videnskabens mand: Fysiologen, formidleren og forskningsaktivisten Poul Brandt Rehberg* (Aarhus: Aarhus Universitetsforlag, 2010), 12. Rehberg later represented Denmark in NATO discussions on science and civil defence. In 1962, he succeeded Niels Bohr as chairman of DAEC. On the Danish peace movement and the place of the world federalist movement within it, see Sune Kaur-Pedersen, "Isoleret og splittet: Den liberale fredsbevægelses krise og marginalisering i Danmark 1949–1960", *Arbejderhistorie* 3 (2008): 9–33.
- 53 Poul Brandt Rehberg, "Hvor stor fare truer menneskene fra de nye brintbombe-forsøg", *Politiken*, 5 May 1957, 29–30.
- 54 Tage Kemp, "Dødsens alvorligt" (with a reply from Rehberg), *Politiken*, 7 May 1957.
- 55 M. Westergaard, "Hvor farlige er bombeforsøgene" (with a reply from Rehberg), *Politiken*, 8 May 1957.
- 56 "A-bombeforsøgene er ufarlige endnu to år, men så må de ophøre", *Socialdemokraten*, 17 July 1957, 6–7.
- 57 Poul Brandt Rehberg, "A- og B-bomber og beskyttelse mod dem", *Orientering fra Civilforsvarsstyrelsen* 12 (11 November 1957): 1–4 (on 3). See also Poul Brandt Rehberg, "De sundhedsmæssige farer ved radioaktivt nedfald", *Civilforsvarsbladet* 8, no. 8 (1957): 170–173.
- 58 This position was echoed in Sven Werner, "Atomalderen er på vej", in *Kvindens Hvem-Hvad-Hvor*, ed. D. Backhausen (Copenhagen: Politikens Forlag, 1959), 5–9.
- 59 Poul Brandt Rehberg, "De Forenede Nationers rapport om atomfaren" (Radio Talk, broadcast 12 September 1958), accessed 1 November 2018, www.dr.dk/bonanza/serie/308/rundt-i-danmark/58326/orientering-de-forenede-nationers-rapport-om-atomfaren.
- 60 On KMA, see Søren Hein Rasmussen, *Sære alliancer: Politiske bevægelser i efterkrigstidens Danmark* (Odense: Odense Universitetsforlag, 1997).
- 61 Sylvest, "Atomfrygten og civilforsvaret".
- 62 See Aksel Larsen, *Den Levende vej: Taler og artikler 1956–1957* (Copenhagen: Eget Forlag, 1958), 190–215. See also Kurt Jacobsen, *Aksel Larsen – en politisk biografi* (Copenhagen: Vindrose, 1993), 489–491 (also 424).
- 63 Aldrig Mere Krig, *Vi vil leve [We Want to Live]* (Svendborg, 1959); Komiteen for oplysning om atomfaren, *En by som København et år efter atombombeangreb* (Copenhagen, 1960).
- 64 Søren Hein Rasmussen, "Kampagnen mod atomvåben og andre protestbevægelser i 1960ernes første halvdel", *Den jyske historiker* 101 (2003): 34–49 (on 36); see also Carl Scharnberg, *Det kan nytte – artikler og erfaringer 1960–1965* (Copenhagen: Borgens Billedbøger, 1965).
- 65 Civilforsvarsstyrelsen, "Atomangreb. Vejledning om beskyttelse", ES, box 171 (folder "Pjece-udkast (plakat): Duurlo"), DNA, undated November 1958. The text was published in *Civilforsvarsbladet* 10, no. 2 (1959): 35–37.
- 66 Rehberg continued to be involved with DCDD through his NATO activities. He only officially asked to be relieved of his duties as scientific advisor in 1960 when he took up a position on the board of the Carlsberg Foundation. At this point, he also left the Danish Defence Research Board. See "Referat af civilforsvarsrådets møde den 5. april 1960", 4–5, Beredskabsstyrelsen: Civilforsvarsrådets møder (1950–1977), 2: Civilforsvarsrådets forretningsudvalgsmøder (hereafter CDM), DNA.
- 67 Photos of the trio from 1958 appear in Schultz' photo album, deposited in ES, DNA.
- 68 J. Ambrosen, "Atombomber", *Polytekniker* 11, no. 10 (1945): 271–282; J. Ambrosen, "Atombomber og Atomenergi", *Naturens Verden* 32 (1948): 65–96.
- 69 Sundhedsstyrelsen, *Journalsager*, 1806–1981, 1956/70/23, DNA.
- 70 Ambrosen, "Det radioaktive nedfald fra atomkernevåben", *Fysisk Tidsskrift* (1958): 1–24; Ambrosen, "Det radioaktive nedfalds egenskaber og virkninger", *Civilforsvarsbladet* 11, no. 6 (1960): 128–130.

- 71 Civilforsvarsstyrelsen, *Memorandum vedrørende den civilforsvarsmæssige beskyttelse mod radioaktivt nedfald* (Copenhagen: Civilforsvarsstyrelsen, 1960), ES: Diverse notater og referater (1947–1983), box 135 (folder: 1954–1970), DNA.
- 72 Civilforsvarsstyrelsen, *Memorandum* (1960), 26–27.
- 73 “Referat af civilforsvarsrådets møde den 5. april 1960”, 10, CDM, DNA.
- 74 Civilforsvarsstyrelsen, *Memorandum* (1960), 37–38, Ch. 6.
- 75 “Referat af civilforsvarsrådets møde den 10. januar 1961”, 11, CDM, DNA.
- 76 Kampagnen mod Atomvåben, *Atomvåben og vor fremtid* (Copenhagen, 1960). KMA also published translated work, including Johan Galtung’s *Ten Arguments Against Nuclear Weapons* (Copenhagen, 1961) and Gerald Piel’s “The Illusion of Civil Defence”, *New Statesman*, 8 December 1961.
- 77 David Jens Adler, ed., *Atomfaren* (Copenhagen: C.A. Reitzels Forlag, 1961); Geertsen, *Radioaktivitet*.
- 78 Anders Dalsager has suggested that this petition was driven by a political objective of countering an irrational approach associated with grassroot campaigning. Rehberg is likely to have played a central role in this effort, and he eventually served on the five-man committee. Anders Dalsager, “Videnskaben som atompolitisk katekese: Politisk udnyttelse af dansk atomoplysning 1960–66”, Paper presented at *Dansk Historikermøde*, Helsingør, 20–22 August 2018. If this is correct, KMA’s savviness in publishing parts of the committee’s (ongoing) work frustrated the plan. When the full report was published in 1963, DCDD read it as supporting the planning efforts already in place. See *Atomvåbenproblemer: En Redegørelse fra Atomoplysningsudvalget*, Betænkning nr. 334 (Copenhagen, 1963), 31–32; “Referat af civilforsvarsrådets møde den 26. november 1963”, 3, CDM, DNA. Surprisingly, KMA’s early publication efforts were apparently discussed in meetings with DCDD. See letter [undated, probably 1962] from Carl Scharnberg to E. Schultz, Danish Civil Defence Agency, ES, Oplysningspjecer 1951–1964, box 173, Folder: “Kampagnen mod Atomvåben, 1962–1963”, DNA.
- 79 Bjørnsson, “Stands tilløb til panik”.
- 80 See, for instance, Børge Chr. Christensen and M. Schroder, eds., *Atomtidens Stråling* (Copenhagen: Fremad, 1961), a textbook published by the Danish Broadcasting Corporation that included chapters on fallout and civil protection.
- 81 “Statement by the Minister of the Interior”, *Folketingstidende, Folketingets forhandlinger 1960–1961* (2. samling), 2 November 1961, 705–715.
- 82 According to a Gallup poll in May 1962, the two leaflets received roughly the same amount of attention from Danish citizens, see *Orientering fra Civilforsvarsstyrelsen* 8, no. 7 (1962): 4.
- 83 *Radioaktivt nedfald* (29 mins., 1961, dir. Helge Robbert). The short version is available at: <https://filmcentralen.dk/museum/danmark-paa-film/film/radioaktivt-nedfald>.
- 84 Lawrence S. Wittner, *A Short History of the World Nuclear Disarmament Movement* (Stanford: Stanford University Press, 2009), Ch. 5.