

SCIENTISTS, THE PUBLIC, THE STATE, AND THE DEBATE OVER THE ENVIRONMENTAL AND HUMAN HEALTH EFFECTS OF NUCLEAR TESTING IN BRITAIN, 1950–1958*

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ABSTRACT. *This article uses the debate over environmental and human health effects of nuclear testing to shed light on the ambivalent relationship between scientists, the public, and the state in Britain during the crucial, but often overlooked, period leading up to the first cycle of anti-nuclear weapons mass protests. In this, it examines how members of Britain's main organization of nuclear scientists – the Atomic Scientists' Association (ASA) – used their expertise in their engagement with both the public and the state to assess these effects of fallout from nuclear testing. What made the ASA stand out from other groups of the atomic scientists' movement was its ambivalent relationship with the government. This was, by and large, the result of several ASA members' occupational backgrounds in government employment and the association's self-imposed adherence to an ambiguous principle of scientific 'objectivity' in political matters. The ASA's role in the debate over fallout thus exemplifies a basic dilemma that many scientists in Britain and other Western liberal democracies faced between their roles as 'objective' and 'unpolitical' scientific experts, on the one hand, and socially responsible scientists, on the other, illustrating the ambivalent position of experts and uses of their knowledge.*

The arrival of thermonuclear weapons during the first half of the 1950s significantly raised awareness about radioactive contamination of the environment through fallout from nuclear testing amongst scientists, the public, and government officials in Britain and the world. At the heart of these growing concerns lay the hydrogen bomb's tremendous explosive power that surpassed

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'conventional' atomic arms considerably; for extensive thermonuclear tests by the two superpowers and Britain led to a release of vast quantities of radioactive debris into the atmosphere.¹ Between October 1952 and September 1958, the United Kingdom alone performed a combined total of some twenty-one nuclear and thermonuclear tests in Australia, Malden, and Christmas Islands in the Pacific. The effects of these trials on the environment and on the health both of populations living in close proximity to the test sites and of personnel participating in these trials remain a matter of dispute to the present day.²

By 1955, the mobilization of the public and scientists against thermonuclear testing in Britain and other countries had substantially increased, in particular in the aftermath of the publication of the 'Russell–Einstein manifesto'. In their statement, philosopher Bertrand Russell and theoretical physicist Albert Einstein warned against the perils that the hydrogen bomb posed to global security, including environmental and health effects of thermonuclear testing and war.³ The 'Russell–Einstein manifesto' also prompted British scientists to act against the perceived threat of fallout from nuclear testing.⁴ And, in April 1957, members of Britain's chief national body of nuclear scientists – the Atomic Scientists' Association (ASA) – issued a 'Statement on strontium hazards'. This largely overlooked missive marked a pivotal contribution by British scientists to the fallout debate at home and abroad.⁵

This article uses the debate over the environmental and health effects of nuclear testing to shed light on the relationship between scientists, the public, and the state in Britain during the crucial period leading up to the first cycle of mass protests against nuclear weapons between 1958 and the

¹ Dee Garrison, *Bracing for Armageddon: why civil defense never worked* (Oxford, 2006), pp. 19–23. On the general history of the H-bomb, see Richard Rhodes, *Dark sun: the making of the hydrogen bomb* (New York, NY, 1995).

² Lorna Arnold, with Katherine Pyne, *Britain and the H-bomb* (Basingstoke, 2001), pp. 129–91, 240–3; Lorna Arnold and Mark Smith, *Britain, Australia, and the bomb: the nuclear tests and their aftermath* (rev. edn, Basingstoke, 2006), pp. 29–48, 49–72, 87–105, 131–71, 189–214, 254–67; John Crawford, "'A political H-bomb": New Zealand and the British thermonuclear weapon tests of 1957–1958', *Journal of Imperial and Commonwealth History*, 26 (1998), pp. 127–50; Roger Cross, 'British nuclear tests and the indigenous people of Australia', in Douglas Holdstock and Frank Barnaby, eds., *The British nuclear weapons programme, 1952–2002* (London, 2003), pp. 76–90; Robert A. Jacobs, 'Nuclear conquistadors: military colonialism in nuclear test site selection during the Cold War', *Asian Journal of Peacebuilding*, 1 (2013), pp. 157–77, at pp. 167–9; Mark D. Merlin and Ricardo M. Gonzalez, 'Environmental impacts of nuclear testing in remote Oceania, 1946–1996', in J. R. Mitchell and Corinna R. Unger, eds., *Environmental histories of the Cold War* (Washington, DC, and Cambridge, 2010), pp. 167–202; Sue Rabbitt Roff, 'Long-term health effects in UK test veterans', in Holdstock and Barnaby, eds., *British nuclear weapons programme*, pp. 101–14, at p. 101.

³ 'Warning by scientists of hydrogen bomb effects: statesmen urged to renounce war', *Times*, 11 July 1955, p. 6.

⁴ Joseph Rotblat, *Science and world affairs: history of the Pugwash Conferences* (London, 1962), pp. 6–7.

⁵ H. S. W. Massey and H. R. Allen, 'H-bomb tests: statement on strontium hazards', *New Scientist*, 25 Apr. 1957, pp. 39–40.

mid-1960s.⁶ In this, it examines how ASA members used their expertise and nuclear knowledge in their engagement with both the public and the state to assess the impact of fallout from nuclear testing on public health and the environment.⁷ What made the ASA stand out from groups of the atomic scientists' movement with similar objectives in other nations was its ambivalent relationship with the government. The ways in which the association dealt with British government offices in the test ban debate, in particular around the time of publication of the 'Statement on strontium hazards', illustrates this impressively. The association's case thus embodies a basic dilemma that many scientists faced in these discussions of the fallout issue between their roles as 'objective' and 'unpolitical' scientific experts, on the one hand, and socially responsible scientists, on the other. This is in the sense that scientific 'objectivity' could undermine scientists' credibility in the public arena, whereas decidedly 'independent' statements, often motivated by a sense of social responsibility and 'duty', could bring these experts into conflict with government policies and views.⁸ At a more fundamental level, the ASA's ambiguous relationship with the state thus also exemplifies, in a British context, what Charles Thorpe elsewhere refers to as 'dilemmas and tensions endemic to the rôle of expert authority in liberal democratic politics'.⁹

Where existing studies have commonly focused on the role of the British government in the nuclear test ban debate, with particular emphasis on Anglo-American relations¹⁰ and British nuclear weapons development and testing at the time,¹¹ the present article explores for the first time the ASA's part in this discussion. While historians have attached great significance to the anti-nuclear weapons mass movement, in particular the Campaign for Nuclear Disarmament (CND), they have commonly sidelined or overlooked the

⁶ On the relationship between scientists, the state, and the public, see Jessica Wang, 'Scientists and the problem of the public in Cold War America, 1945–1960', *Osiris*, 2nd ser., 17 (2002), pp. 323–47.

⁷ On the political use of nuclear knowledge, see Lawrence Badash, *A nuclear winter's tale: science and politics in the 1980s* (Cambridge, MA, 2009).

⁸ Toshihiro Higuchi, 'Radioactive fallout, the politics of risk, and the making of global environmental crisis, 1954–1963' (Ph.D. thesis, Georgetown University, 2011), pp. 10–11.

⁹ Charles Thorpe, 'Disciplining experts: scientific authority and liberal democracy in the Oppenheimer case', *Social Studies of Science*, 32 (2002), pp. 525–62, at p. 528.

¹⁰ Ian Clark, *Nuclear diplomacy and the special relationship: Britain's deterrent and America, 1957–1962* (Oxford, 1994); Kendrick Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate, 1961–1963* (Basingstoke, 1998); Richard Moore, *Nuclear illusion, nuclear reality: Britain, the United States, and nuclear weapons, 1958–1964* (Basingstoke, 2010); John R. Walker, *British nuclear weapons and the test ban, 1954–1973: Britain, the United States, weapons policy, and nuclear testing: tensions and contradictions* (Farnham, 2010).

¹¹ Arnold, *Britain and the H-bomb*; Arnold and Smith, *Britain, Australia, and the bomb*; Crawford, "'A political H-bomb'", pp. 127–50; Cross, 'British nuclear tests', pp. 76–90; Merlin and Gonzalez, 'Environmental impacts', pp. 167–202; Roff, 'Long-term health effects', pp. 101–14; Joan Smith, *Clouds of deceit: the deadly legacy of Britain's bomb tests* (London, 1985).

importance of scientists' activism as a chief precondition for these protests.¹² If scientists in general did not adequately feature in existing accounts, the historiographical fate of the ASA has been more severe. Despite being the country's main forum of nuclear scientists, it has effectively been written out of the history of scientists' resistance against British nuclear arms policy.¹³

The ASA's foundation dated back to March 1946, when sixteen nuclear scientists, including Patrick Blackett, Eric Burhop, Gwyn Owain Jones, Harrie Massey, Marcus Oliphant, Rudolf Peierls, Joseph Rotblat, and Franz (Francis) Simon, who had by and large participated in the creation of the first atomic bombs during the Second World War, founded the association out of the social responsibility that they felt was emerging from their wartime work. Modelled on the Federation of American Scientists (FAS), which represents perhaps *the* best-known national organization of the atomic scientists' movement, the ASA had three key objectives: the establishment of an international system of controlling atomic energy (later replaced with non-proliferation), public nuclear information and education, as well as advising political decision-makers on both military and civilian applications of nuclear energy.¹⁴ Compared with the FAS, the ASA was a relatively small organization with around 140 full and an additional 500 associate members at its zenith.¹⁵

Many ASA members had previously engaged in work of the short-lived Atomic Scientists' Committee (ASC) that had operated under the umbrella of the Association of Scientific Workers (AScW). Several ASC members, however, rejected the AScW's strong political mindedness from the start, calling for the creation of the ASA as an independent entity. While the AScW was a trade union that represented a wide array of scientific workers and, as such, often made political statements, ASA members perceived of their organization as an 'objective' body of atomic experts. This elitist notion of nuclear expertise translated into rigid membership criteria that only entitled atomic scientists to full membership in the association.¹⁶

These experts followed a supposedly 'objective', yet in fact ambiguous approach to politics through the application of a scientific principle of 'objectivity'

¹² This trend has existed for decades. Cf. Frank Parkin, *Middle-class radicalism: the social bases of the Campaign for Nuclear Disarmament* (Manchester, 1968); Arthur J. R. Groom, *British thinking about nuclear weapons* (London, 1974); Richard Taylor, *Against the bomb: the British peace movement, 1958–1965* (Oxford, 1988); Holger Nehring, *Politics of security: British and West German protest movements and the early Cold War, 1945–1970* (Oxford, 2013).

¹³ See in particular the pioneering study by Greta Jones, 'The mushroom-shaped cloud: British scientists' opposition to nuclear weapons policy, 1947–1957', *Annals of Science*, 43 (1986), pp. 1–26. For a notable exception to this trend, see Higuchi, 'Radioactive fallout'.

¹⁴ Christoph Laucht, *Elemental Germans: Klaus Fuchs, Rudolf Peierls, and the making of British nuclear culture, 1939–1959* (Basingstoke, 2012), pp. 133–50; Alice Kimball Smith, *A peril and a hope: the scientists' movement in America, 1945–1947* (Chicago, IL, 1965), p. 238.

¹⁵ Rudolf Peierls, 'The British Atomic Scientists' Association', *Bulletin of the Atomic Scientists (BAS)*, 6 (1950), p. 59.

¹⁶ Jones, 'Mushroom-shaped cloud', p. 7; Laucht, *Elemental Germans*, pp. 131–2, 135.

to political matters. Membership of several government employees in the ASA's governing council necessitated such a 'neutral' take on politics, from the association's point of view, in order not to disconcert the British government.¹⁷ In addition, the ASA's governance structure through a directly elected council that comprised a president, a secretary, and several vice-presidents who had to reach decisions unanimously affected the association's capacity to act.¹⁸ Alongside some council members' status as government employees, councillors' broad range of political views, including both critics of government policy such as Patrick Blackett and Eric Burhop as well as government loyalists such as Sir George Thomson and Lord Cherwell, often paralysed the association's actionability and prevented the ASA from commenting on key political developments as, for example, the Truman administration's announcement in 1950 to create the H-bomb. These factors contributed to the association's loss of credibility as an expert organization and, ultimately, its decline.¹⁹

The 'Statement on strontium hazards' represented both a rare and final moment of publicity for the ASA. The report was produced at a time when knowledge of the public health implications from fallout was only just developing. It warned of the dangers that internal radiation through the radioactive isotope strontium-90 posed to human health, offering an alternative assessment to official British government estimates on the potential impact of fallout from nuclear testing on humans and the environment.²⁰ Strontium-90 is a fission product that occurred in increasing amounts in the atmosphere as a consequence of extensive nuclear testing in the 1950s. If consumed through contaminated food or drink, especially milk, strontium-90 can act as a carcinogen in human teeth and bones. Consequently, the isotope became a major focus of attention by scientists, the public, and the government in the test ban debate.²¹

I

Awareness of radiation-induced effects on health and the environment – a crucial prerequisite for comprehending the debate over nuclear fallout in the 1950s – pre-dated this period by several decades. During the 1920s, reports about the harmful effects of radiation on human health appeared. As early as 1921, *The Times* reported on a possible causal link between radiation emitted from x-rays and radium and cancer and genetic defects.²² Perhaps most

¹⁷ Fishenden to Schonland, 10 Feb. 1958, The National Archives (TNA), AB 27/6.

¹⁸ Rudolf Peierls, *Bird of passage: recollections of a physicist* (Princeton, NJ, 1985), p. 283.

¹⁹ Laucht, *Elemental Germans*, pp. 159–64, 167.

²⁰ Massey and Allen, 'H-bomb tests', pp. 39–40.

²¹ Robert A. Divine, *Blowing on the wind: the nuclear test ban debate, 1954–1960* (New York, NY, 1978), pp. 184–5.

²² Robert Knox, 'Science and its martyrs: pioneers' need of protection', *Times*, 29 Mar. 1921, p. 9; 'An x-ray crisis: the danger to reproduction', *Times*, 31 Mar. 1921, p. 8; 'X-rays and cell life: lines of research', *Times*, 1 Apr. 1921, p. 5; 'X-ray dangers: how to protect workers', *Times*, 24 June 1921, p. 12.

notably, radium poisoning of industrial workers at watch and clock factories, primarily in the United States, raised alarm about the health effects of radioactivity.²³

The next important steps in the evolution of radiation and fallout awareness followed during the Second World War. Radiation safety procedures significantly improved in the workplace over the course of the wartime British–American–Canadian nuclear weapons development programme – the so-called Manhattan Project.²⁴ At the same time, scientists arrived at a fuller understanding of nuclear weapons effects. In 1940, the émigré physicists Otto Frisch and Rudolf Peierls addressed the fallout issue for the first time in a secret feasibility study on developing atomic arms for the British government – albeit in a theoretical way. ‘Owing to the spreading of radioactive substances with the wind, the bomb could probably not be used without killing large numbers of civilians’, warned the ‘Frisch–Peierls memorandum’.²⁵ In the aftermath of the world’s first atomic test in New Mexico in the south-western United States on 16 July 1945, Manhattan Project scientists detected fallout from an actual nuclear explosion. That they traced radioactive residue as far away from the test site as Rochester, New York, gave a first powerful indication of the wide dispersal of fallout through nuclear explosions.²⁶

The subsequent atomic bombings of the Japanese cities of Hiroshima and Nagasaki on 6 and 9 August 1945 respectively then revealed the impact of radiation and fallout on inhabited urban areas and placed the scientists behind the creation of these weapons in the public eye.²⁷ The news of Hiroshima and Nagasaki produced an ambiguous response from the British public between relief about the end of the Second World War and fears of future nuclear war.²⁸ ‘The first reaction of the majority of people when they first heard the

²³ Luis Campos, ‘The birth of living radium’, *Representations*, 97 (2007), pp. 1–27; Marjorie C. Malley, *Radioactivity: a history of a mysterious science* (Oxford, 2011), pp. 169–72; Spencer R. Weart, *The rise of nuclear fear* (Cambridge, MA, 2012), p. 30.

²⁴ Barton C. Hacker, *The dragon’s tail: radiation safety in the Manhattan Project, 1942–1946* (Berkeley, CA, 1992); J. Samuel Walker, *Permissible dose: a history of radiation protection in the twentieth century* (Berkeley, CA, 2000), p. 9.

²⁵ This quote stems from the first part of the document: Otto Frisch and Rudolf Peierls, ‘Memorandum on the properties of a radioactive “super-bomb”’, n.d., p. 2, TNA, AB 1/210. On the importance of the document, see Lorna Arnold, ‘The history of nuclear weapons: the Frisch–Peierls memorandum on the possible construction of atomic bombs of February 1940’, *Cold War History*, 3 (2003), pp. 111–26.

²⁶ Ferenc M. Szasz, *The day the sun rose twice: the story of the Trinity Site nuclear explosion July 16, 1945* (Albuquerque, NM, 1984), pp. 115–29, 134.

²⁷ ‘Atomic bomb in use against Japs’, *Daily Mirror*, 7 Aug. 1945, p. 1; ‘The bomb that has changed the world’, *Daily Express*, 7 Aug. 1945, p. 1; ‘First atomic bomb hits Japan’, *Times*, 7 Aug. 1945, p. 4; ‘Scientists whose research gave Britain and America the secrets of atomic energy’, *Picture Post*, 25 Aug. 1945, pp. 12–13; ‘Atomic bomb used on Japan’, *Manchester Guardian*, 7 Aug. 1945, p. 5.

²⁸ ‘The atom bomb’, Aug. 1945, file report, 2277, Mass Observation Archive, University of Sussex, Brighton, United Kingdom; George H. Gallup, ed., *The Gallup international public opinion polls: Great Britain, 1937–1975* (2 vols., New York, NY, 1976), 1, pp. 132, 183–4.

news that an atom-bomb had been dropped on Japan was horror mixed with fear', recorded a Mass Observation report.²⁹

More specifically, the two nuclear attacks had a catalytic effect on the mobilization of British nuclear scientists, accelerating the formation process of the ASA and leading to its formation in March 1946, as described earlier on.³⁰ The year the ASA formed also witnessed an event that was crucial for sharpening scientific and public awareness of fallout: in the summer of 1946 the United States government performed Operation Crossroads, the first two post-war atomic tests, on the Bikini Atoll in the Pacific. These trials led to increased public awareness of radioactive fallout, and newspapers reported, for example, about radiation effects on animals involved in such testing.³¹ 'The public is only now beginning to realize that the radiation from an atom bomb is a destructive agent so far unique in the history of warlike invention', warned an editorial in *The Times*.³² In addition, the publication of an official government report, *The effects of the atomic bombs at Hiroshima and Nagasaki*, by a British scientific team that had visited the two cities in November 1945 coincided with Operation Crossroads. The report informed the British public in detail about the two atomic attacks, including radiation effects on humans and the environment, and thus gave the fallout issue further currency.³³ But radiation and fallout remained of public interest after 1946, partly thanks to physician David Bradley's eyewitness account of Operation Crossroads. Published in Britain in 1949, Bradley's *No place to hide* was an important text for furthering public understanding of the radiological dimensions of nuclear testing, since it featured 'A layman's guide to the dangers of radioactivity'.³⁴

II

If the 1946 Bikini tests sensitized many British scientists and the public to the dangers emanating from atomic explosions, the coming of the hydrogen bomb during the early 1950s moved the debate over the environmental impact of nuclear fallout to an entirely new level. Starting with United States President Truman's announcement in February 1950 that his administration sought to develop thermonuclear weapons, the British news media covered

²⁹ 'Public reaction to the atom bomb', 24 Aug. 1945, file report, 2272, Mass Observation Archive.

³⁰ Laucht, *Elemental Germans*, pp. 128–34.

³¹ 'First observations of the atomic bomb damage', *Manchester Guardian*, 2 July 1946, p. 5; 'Animals in Bikini fleet', *Manchester Guardian*, 5 July 1946, p. 5; 'Holocaust at Bikini', *Times*, 2 July 1946, p. 4.

³² 'Bikini', *Times*, 1 July 1946, p. 5.

³³ The British Mission to Japan, *The effects of the atomic bombs at Hiroshima and Nagasaki* (London, 1946), pp. 15, 21; 'Hiroshima to Bikini', *Manchester Guardian*, 2 July 1946, p. 4; 'The last chance', *Daily Mirror*, 29 June 1946, p. 2.

³⁴ David Bradley, *No place to hide* (Boston, MA, 1948; London, 1949), pp. 169–82.

the H-bomb.³⁵ In October of the same year, the ASA and the London-based Institute of Biology addressed the emerging fallout issue as part of a joint conference on the ‘Biological hazards of atomic energy’.³⁶ Around the same time, British and American scientists, as well as popular media, also focused more attention on atomic tests and fallout through their discussions of the use of H-bombs to spread radioactive fallout as a form of ecological warfare.³⁷ Similarly, scientists and the British public debated possible adverse effects of nuclear testing on the climate and weather.³⁸

In March 1954, a thermonuclear test – codenamed Castle-Bravo – by the United States in the Pacific marked a key moment for sharpening scientific and public fallout awareness in Britain and elsewhere, contributing substantially to the emergence of the nuclear test ban debate. ‘It was the Bravo test that put the word *fallout* [original emphasis] into the public vocabulary’, Robert Jacobs rightly observes.³⁹ In an opinion poll conducted in the immediate aftermath of the test, 88 per cent of the respondents stated they were aware of the recent ‘powerful’ Castle-Bravo trial, and 74 per cent deemed it ‘[d]esirable’ to outlaw nuclear weapons.⁴⁰ These results not only demonstrate Castle-Bravo’s role in heightening public awareness of thermonuclear arms and their effects but its high impact on public mobilization against the H-bomb.

In particular, the plight of the crew of the Japanese fishing vessel *Daigo Fukuryū Maru (Lucky Dragon Five)*, who had been exposed to dangerous levels of fallout while cruising outside the test exclusion zone, had wide repercussions. The incident alerted, on an unprecedented scale, scientists, the public, and governments around the world to the dangers of radioactive fallout and sparked a

³⁵ ‘United States to work on hydrogen bomb’, *Times*, 1 Feb. 1950, p. 4; ‘A possible destroyer of the world illustrated diagrammatically’, *Illustrated London News (ILN)*, 4 Feb. 1950, pp. 176–7; ‘Truman orders “go ahead” on H-bomb’, *Daily Mirror*, 1 Feb. 1950, pp. 1, 27; ‘U.S. starts on the bomb’, *Daily Express*, 1 Feb. 1950, p. 1; ‘Work to begin on hydrogen bomb’, *Manchester Guardian*, 1 Feb. 1950, p. 7.

³⁶ ‘Biological hazards of atomic energy’, *Nature*, 167 (3 Mar. 1951), pp. 335–8, at p. 335; Alexander Haddow, ed., *Biological hazards of atomic energy: being the papers read at the conference convened by the Institute of Biology and the Atomic Scientists’ Association October 1950* (Oxford, 1952).

³⁷ James R. Arnold, ‘The hydrogen-cobalt bomb’, *BAS*, 6 (1950), pp. 290–2; William Laurence, ‘Ending of all life by hydrogen bomb held a possibility’, *New York Times*, 27 Feb. 1950, pp. 1, 7; Frank R. N. Nabarro, ‘The possible scale of radioactive contamination by the fission products of uranium 235’, *Atomic Scientists’ News (ASN)*, 3 (1950), pp. 166–8; Derek Wragge Morley, ‘Can man survive the hydrogen bomb?’, *Picture Post*, 18 Feb. 1950, pp. 31–7, at pp. 31, 36–7. P. D. Smith explores the history of this weapon in *Doomsday men: the real Dr Strangelove and the dream of the superweapon* (London, 2007).

³⁸ ‘Atomic weather’, May 1947, file report, 2485, Mass Observation Archive; Gallup, ed., *Gallup international public opinion polls*, 1, pp. 350, 480; Cyril Ramsay Jones, ‘Has our weather been atomised?’, *Picture Post*, 29 Aug. 1953, p. 18; Charles-Noël Martin, ‘Do the bombs affect the weather?’, *Picture Post*, 2 Apr. 1955, pp. 33, 35; P. A. Sheppard, ‘Radioactive fallout and the weather’, *New Scientist*, 15 Aug. 1957, pp. 23–5; Kenneth Walker, ‘Monkeying with the weather’, *Picture Post*, 21 Jan. 1956, p. 46.

³⁹ Robert A. Jacobs, *The dragon’s tail: Americans face the atomic age* (Amherst, MA, 2010), p. 10.

⁴⁰ Gallup, ed., *Gallup international public opinion polls*, 1, p. 320.

debate over hazards from nuclear testing.⁴¹ The British press also covered the *Lucky Dragon* incident.⁴² *The Times* reported about ‘radioactivity hysteria’ in Japan as a consequence of the irradiation of the ship’s crew,⁴³ while columnist William Connor, alias ‘Cassandra’, treated the subject with cynicism.⁴⁴ The fact that the Castle-Bravo test coincided with the release of official images of the United States’ first thermonuclear test in 1952 provided powerful illustrations for demonstrating the H-bomb’s yield at a moment of growing concerns over fallout effects from nuclear testing.⁴⁵

The Castle-Bravo test also led British scientists to study the fallout issue in more depth. The ASA’s *Atomic Scientists’ Journal* featured several articles on the effects of thermonuclear testing and the scattering of fallout in Britain and the wider world.⁴⁶ Through an initiative by American scientist Eugene Rabinowitch in May 1954, ASA members also became more deeply involved in transnational activism against thermonuclear testing. Rabinowitch, a key figure in the FAS and editor of the influential *Bulletin of the Atomic Scientists*, proposed an international conference on the H-bomb.⁴⁷ Rabinowitch’s idea eventually culminated in the creation of the ASA’s Committee on Radiation Hazards, which was behind the ‘Statement on strontium hazards’, with Joseph Rotblat at the helm, as we shall see later on.⁴⁸

III

Alongside scientists and the public, the *Lucky Dragon* incident affected the British government, as it brought the hydrogen bomb to the top of the political agenda. In a Gallup poll of April 1954, the hydrogen bomb ranked as the British

⁴¹ Divine, *Blowing on the wind*, pp. 3–35; Jones, ‘Mushroom-shaped cloud’, pp. 13–18.

⁴² Adrian Bingham, ‘“The monster”?: the British popular press and nuclear culture, 1945–early 1960s’, *British Journal for the History of Science*, 45 (2012), pp. 609–24, at pp. 616–18.

⁴³ ‘Radioactive fish’, *Times*, 20 Mar. 1954, p. 5.

⁴⁴ Cassandra, ‘Dearly beloved bomb’, *Daily Mirror*, 29 Mar. 1954, p. 7; Cassandra, ‘A child’s guide to the bomb’, *Daily Mirror*, 6 Apr. 1954, p. 9.

⁴⁵ Bingham, ‘“The monster”’, pp. 617–18; ‘The hydrogen bomb that “misfired”’, *ILN*, 10 Apr. 1954, pp. 586–7.

⁴⁶ Santimay Chatterjee, ‘Radioactive ashes over Calcutta and a method of dating a nuclear explosion’, *Atomic Scientists’ Journal (ASJ)*, 4 (1955), pp. 273–8; ‘Genetic effects of nuclear explosions’, *ASJ*, 4 (1955), p. 202; Harold A. Knapp, ‘South Woodley looks at the H-bomb’, *ASJ*, 4 (1955), pp. 261–72; Yasushi Nikushiwaki, ‘Effects of H-bomb tests in 1954’, *ASJ*, 4 (1955), pp. 279–88. Note that the ASN was renamed the *ASJ* in September 1953.

⁴⁷ BAS, ‘Memo: international congress of scientists’, 29 May 1954, the Papers of Professor Sir Joseph Rotblat, the Churchill Archives Centre, Churchill College, University of Cambridge, Cambridge (RTBT), K. 112.

⁴⁸ ‘Notes on meeting of sub-committee on international conference on 28th October, 1954. (Mrs. Lonsdale, Walton, Hodgson, and Rotblat)’, n.d., RTBT, K. 114; Committee I, ‘Hazards arising from the use of atomic energy in peace and war’, *BAS*, 13 (1957), p. 251; Rotblat to Rabinowitch, 29 Oct. 1954, RTBT, K. 114; H. R. Allen, ‘Minutes of the 87th council meeting, held in the Physics Library, Imperial College, London, S.W.7. on Saturday February 2nd, 1957 at 10.45 a.m.’, 3 Feb. 1957, pp. 2–3, RTBT, K. 124.

government's main problem (24 per cent) ahead of foreign policy (18 per cent) and the cost of living (17 per cent).⁴⁹ To make matters worse for Whitehall, the catastrophic consequences of the Castle-Bravo test prompted the Labour-dominated Coventry city council to reject the allocation of funding for civil defence operations, arguing that effective defence against the hydrogen bomb was impracticable.⁵⁰ This political move received some media attention.⁵¹ Although largely unfavourable to the council's vote, public opinion of the efficiency of civil defence had already turned sour by 1950. By May 1954, 61 per cent of respondents to a Gallup poll even believed 'an atomic war would...destroy civilisation as we know it'. And, what is more, the public demanded more information from the government on the effects of nuclear weapons.⁵² In this context, Coventry city council's vote had potentially far-reaching consequences for the government, encouraging other councils to follow suit.⁵³ These events thus pressured Whitehall to respond to the issues of fallout and nuclear testing, as the emerging debate over these matters threatened to incite calls for a nuclear test ban that would jeopardize the existence of Britain's nuclear and thermonuclear programmes.

These developments occurred at a difficult time for the government, which was in a quandary over starting its own H-bomb programme. While the superpowers had successfully tested thermonuclear devices (the United States in 1952 and the Soviet Union in 1953), Britain had only just completed the development of its first 'conventional' atomic bombs. 'The British government was faced with the difficult decision of whether to stay in the technological race with the superpowers, despite the severe economic pressures on defence expenditure', John Baylis argues, 'or to opt out, revealing dramatically Britain's second-class status.'⁵⁴ Whitehall chose to remain in competition with the United States and the Soviet Union, and, in February 1955, Prime Minister Winston Churchill declared in parliament his government's intention to pursue its own hydrogen bomb project.⁵⁵

While Churchill's H-bomb announcement provoked leading British scientists such as Joseph Rotblat, the president of the British Association for the

⁴⁹ Gallup, ed., *Gallup international public opinion polls*, 1, p. 323.

⁵⁰ Jones, 'Mushroom-shaped cloud', p. 15.

⁵¹ 'Coventry's vote on the hydrogen bomb', *Times*, 7 Apr. 1954, p. 8; "'Duty of civil defence'", *Times*, 12 Apr. 1954, p. 8; 'Coventry to discuss Home Office letter', *Times*, 13 Apr. 1954, p. 3; Frank Raine-Allen, Darwen, K. D. Courtney, C. W. Judd, and L. O. Lyne, 'The hydrogen bomb', *Times*, 9 Apr. 1954, p. 9; Tim Raison, 'Who is right in the row about civil defence?', *Picture Post*, 16 Oct. 1954, pp. 20–1, 53.

⁵² Gallup, ed., *Gallup international public opinion polls*, 1, pp. 224, 310, 324–5.

⁵³ Matthew Grant, *After the bomb: civil defence and nuclear war in Britain, 1945–1968* (Basingstoke, 2010), pp. 77–81.

⁵⁴ John Baylis, *Ambiguity and deterrence: British nuclear strategy, 1945–1964* (Oxford, 1995), p. 180.

⁵⁵ Cmnd 9391, *Statement on defence 1955: presented by the minister of defence to parliament by command of Her Majesty, February 1955* (London, 1955), p. 1.

Advancement of Science Lord Adrian, and geneticist and evolutionary biologist John B. S. Haldane to warn publicly against the environmental and health effects of thermonuclear testing, public opinion was principally in favour of Whitehall's decision to acquire an independent thermonuclear deterrent.⁵⁶ This suggests considerable ambivalence in public opinion on atomic arms. A majority approved in principle of British nuclear arms for reasons of national security (after all, an even higher percentage of respondents had welcomed Britain's entry into the 'nuclear club' in 1952), whereas many were at the same time open to multilateral nuclear disarmament, expressed doubt at the effectiveness of civil defence measures against thermonuclear attack, and demanded that the government reveal more about the effects of nuclear weapons.⁵⁷

In line with Whitehall's decision to develop the hydrogen bomb, British nuclear strategy underwent a fundamental shift towards recognizing the H-bomb's primary function as a deterrent and not a war-fighting weapon.⁵⁸ This alteration lay, to a large extent, rooted in the growing awareness of the hydrogen bomb's vast yield and ability to cause large-scale atmospheric radioactive contamination. In 1955, a secret report by a study group under William Strath, the director of the Cabinet Office's Central War Plans Secretariat, exposed the vulnerability of the country to full-scale thermonuclear attack.⁵⁹ Jeff Hughes observes on one of the main conclusions of the 'Strath report' that 'the threat of fallout necessitated a reconceptualization of the British state' and its civil defence operations.⁶⁰ But the British government did not act on Strath's recommendations. Instead, political decision-makers now viewed civil defence as an integral component of deterrence rather than an 'insurance policy' against thermonuclear attack. For a credible deterrent that suggested to a potential aggressor the British government's willingness to use its thermonuclear weapons depended in part on the existence of a civil defence programme. In this calculation, the actual efficiency of civil defence measures became a secondary concern, as Melissa Smith argues, 'and [it became] more important that the plans *appeared* [original emphasis] convincing – both to the enemy, who had to be deterred from attacking, and to the British people, who had to be persuaded to support an expensive nuclear weapons programme'. Whitehall's decision to move away 'from focusing on

⁵⁶ John B. S. Haldane, 'H-bomb dust', *Picture Post*, 23 Apr. 1955, pp. 11–12; 'Science must warn mankind', *Picture Post*, 23 Apr. 1955, p. 13; Gallup, ed., *Gallup international public opinion polls*, 1, pp. 345, 346, 348, 357.

⁵⁷ Gallup, ed., *Gallup international public opinion polls*, 1, p. 263.

⁵⁸ Baylis also makes a point about economic considerations in *Ambiguity and deterrence*, pp. 245–50.

⁵⁹ Peter Hennessy, *The secret state: preparing for the worst, 1945–2010* (2nd edn, London, 2010), pp. 163–77.

⁶⁰ Jeff Hughes, 'The Strath report: Britain confronts the H-bomb, 1954–1955', *History and Technology*, 19 (2003), pp. 257–75, at p. 263.

relatively expensive life-saving measures – such as shelters or stockpiling – towards measures which would be most apparent to the public at the lowest possible cost’ reflected this policy change.⁶¹

Such inexpensive measures as the Home Office’s civil defence booklet *The hydrogen bomb* (1957) failed, however, to deliver the government’s supposedly reassuring message that civil defence against thermonuclear attack was, in principle, practicable.⁶² The *Illustrated London News* criticized that ‘the effects of radio-active fall-out, the gradual fall to earth of particles made radio-active in the explosion, are more far-reaching’ than described in the booklet.⁶³ If the press had problematized civil defence policy and exercises from the late 1940s⁶⁴ and many ASA members had questioned the feasibility of effective defence against atomic weapons altogether,⁶⁵ the Macmillan government unintentionally provided further ammunition for critics of both Britain’s nuclear deterrent and civil defence operations through the publication of the 1957 white paper on defence. Following a prolonged and intense internal debate in government, the document marked the official public proclamation of a deliberate change in British defence policy towards fully committing the country to nuclear deterrence. Simultaneously, it proposed the reduction of large conventional armed forces, including the abolition of the conscription. Where the government emphasized the H-bomb’s massive explosive power in an attempt to defend its reliance on an independent thermonuclear deterrent, it failed, at the same time, to formulate a new civil defence policy that adequately explained the downscaling of civil defence operations. Many critics of British nuclear policy viewed the absence of any such policy statement as a confession by the government that the existence of thermonuclear arms rendered civil defence measures futile.⁶⁶

While official civil defence publications such as *The hydrogen bomb* booklet might ostensibly suggest a one-dimensional line of officialdom on thermonuclear weapons, testing, and fallout, the government’s position on these

⁶¹ Melissa Smith, ‘“What to do if it happens”: planners, pamphlets, and propaganda in the age of the H-bomb’, *Endeavour*, 33 (2009), pp. 60–4, at p. 62.

⁶² Home Office, *The hydrogen bomb* (London, 1957).

⁶³ ‘The hydrogen bomb’, *ILN*, 5 July 1958, pp. 24–5, at p. 25.

⁶⁴ ‘How the government is preparing for atomic warfare’, *ILN*, 18 July 1949, p. 839; ‘Civil defence is an essential fourth arm’, *ILN*, 3 Dec. 1949, pp. 844–5; ‘Civil defence in the Atomic Age’, *ILN*, 17 Feb. 1951, p. 242; John Stobbs, ‘Civil defence: do we need it?’, *Picture Post*, 4 Oct. 1952, pp. 27–9.

⁶⁵ ‘The atom bomb and civil defence’, *ASN*, 2 (1948), pp. 62–4; ‘Atomic weapons and civil defence’, *ASN*, 3 (1949), pp. 10–16, at pp. 12–13. ‘Editorial’, *ASN*, 1 (1952), pp. 181–2; E. C. Allen, ‘The assessment of atomic casualties’, *ASN*, 1 (1952), pp. 184–92; W. G. Marley, ‘Radioactivity and civil defence’, *ASN*, 1 (1952), pp. 193–7; D. G. Arnott, ‘Atomic warfare: the biological component’, *ASN*, 1 (1952), pp. 198–209; Claude Frankau, ‘The casualty service’, *ASN*, 1 (1952), pp. 210–14; Sidney L. Harford, ‘Civil defence: administration and organisation’, *ASN*, 1 (1952), pp. 215–20.

⁶⁶ Matthew Grant, ‘Home defence and the Sandys defence white paper, 1957’, *Journal of Strategic Studies*, 31 (2008), pp. 925–49.

issues was in fact much more complex, especially after Harold Macmillan became prime minister in January 1957. If the internal debate over the 1957 defence white paper within Macmillan's cabinet was testament to this, the prime minister himself held multiple, at times conflicting, views on these issues. 'Macmillan's persistent pursuit of a test-ban agreement, his advocacy of more advanced negotiating positions and his horror at the prospect of further tests were informed as much by domestic political considerations', argues Kendrick Oliver, 'by his conviction that the West could not neglect the concerns of non-aligned nations and by his personal dread of an unconstrained arms race as by the desire to preserve Britain's select status as one of only three nuclear powers'.⁶⁷ The complexity of views held on thermonuclear arms by the prime minister and other government offices mark examples of what Richard Maguire refers to as 'nuclear cultures in British government', unmasking the heterogeneity of government bureaucracies in their approaches to the hydrogen bomb.⁶⁸

What further complicated the situation for Macmillan (as for other prime ministers) was the fact that Britain's military and peaceful atomic energy programmes were closely entangled. Hence, the government showed concern about the negative impact that growing public opposition to fallout and nuclear testing might have on the country's fledgling civilian nuclear energy programme.⁶⁹ These worries then help to explain why consecutive British governments often emphasized the effectiveness of radiation safety measures and procedures in force at nuclear research facilities such as the Atomic Energy Research Establishment Harwell in official publications, including *Britain's atomic factories* (1954) and *Nuclear energy in Britain* (1957), as well as propaganda films such as *Atoms at work* (1952), *Atomic achievement* (1956), and *Building for the nuclear age* (1960).⁷⁰

On the government's side, the Medical Research Council (MRC) was instrumental in investigating potential dangers of fallout from nuclear testing. In March 1955, Whitehall authorized the MRC to prepare a report on the effects of radioactive fallout.⁷¹ Four senior ASA members participated in the preparation of the missive, which demonstrated the association's deep entanglement with British government agencies and would later generate some

⁶⁷ Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate*, p. 2.

⁶⁸ Richard Maguire, "'Never a credible weapon": nuclear cultures in British government during the era of the H-bomb', *British Journal for the History of Science*, 45 (2012), pp. 519–33.

⁶⁹ Lorna Arnold, *Windscale 1957: anatomy of a nuclear accident* (2nd edn, Basingstoke, 1995), pp. xxi–xxii.

⁷⁰ Central Office of Information, *Nuclear energy in Britain* (1957; repr. London, 1960), pp. 41–8; Kenneth Jay, *Britain's atomic factories: the story of atomic energy production in Britain* (London, 1954), pp. 55–67; Kenneth Jay, *Harwell: the atomic energy research establishment, 1946–1951* (London and New York, NY, 1952), pp. 56–65; *Atoms at work* (United Kingdom, 1952); *Atomic achievement* (United Kingdom, 1956); *Building for the nuclear age* (United Kingdom, 1960).

⁷¹ *Parliamentary debates* (Commons), vol. 539, 29 Mar. 1955, col. 197.

controversy within the ASA and in its relations with government offices. Besides the MRC Secretary Sir Harold Himsworth, who directed the Committee on the Hazards of Nuclear Radiation in charge of compiling the statement, the ASA members Alexander Haddow, Sir John Cockcroft, and Lionel Sharples Penrose served on the board.⁷² The report's publication the following year represented a key part of the government's official response to the fallout issue. At the same time, it demonstrates both the reciprocal dynamics at play in the fallout debate, as the statement mobilized scientists and the public against fallout, as well as the ASA's ambivalent position vis-à-vis Whitehall.

Entitled *The hazards to man of nuclear and allied radiations*, the report discerned the dangers of external and internal radiation. Although it rejected current and future health and environmental effects of external radiation from nuclear fallout at the 1956 rate as 'negligible', the study acknowledged that an increase in internal radiation through rising levels of strontium-90 intake into the human body could 'be approaching levels at which ill-effects might be produced in a small number of the population'.⁷³ While this cautious wording of possible public health effects from increased strontium-90 levels exemplifies that knowledge of fallout was still developing, it was precisely this vague assumption that received attention in the news media.⁷⁴

Given the great relevance of the fallout issue, cabinet members attempted to assess the impact of the MRC report on public opinion prior to its publication. Foreign Secretary Selwyn Lloyd believed 'the report will be more reassuring than public opinion expects' on the link between genetic defects and nuclear testing. At the same time, he warned that it could 'evoke much interest and may lead to renewed pressure for the cessation of all tests' – a possibility that he ruled out on account of 'far-reaching effects on both the foreign and defence policies of the United Kingdom'.⁷⁵ Lord Strathclyde, the minister of state for Scotland, feared that the part on strontium-90 storage in the human skeleton was '[I]able to cause public alarm'.⁷⁶

To ensure the MRC report gained maximum publicity, the British government co-ordinated its publication date with the Eisenhower administration. The imminent release of a similar statement on fallout by Willard F. Libby of the

⁷² Lord Salisbury, 'Cabinet: nuclear and allied radiations, memorandum by the lord president of the council', 1 June 1956, pp. 1–2, TNA, CAB 129/81; D. A. G. Galton, 'Haddow, Sir Alexander (1907–1976)', *Oxford dictionary of national biography (ODNB)*.

⁷³ Cmd 9780, Medical Research Council (MRC), *The hazards to man of nuclear and allied radiations: presented by the lord president of the council to parliament by command of Her Majesty, 1956* (London, 1956), p. 80.

⁷⁴ See, for example, 'Hazards in radiation', *Times*, 13 June 1956, p. 10.

⁷⁵ Selwyn Lloyd, 'Cabinet: nuclear tests, memorandum by the secretary of state for foreign affairs', 1 June 1956, pp. 1–2, TNA, CAB 129/81.

⁷⁶ Norman Brook, 'Cabinet minutes, CM (56) 40th meeting (7 June 1956)', in Norman Brook, 'Cabinet minutes, CM (56) 37th meeting – CM (56) 104th meeting (17 May 1956–20 December 1956)', TNA, CAB 195/15.

United States Atomic Energy Commission influenced this decision. That the two reports represented the first of their kind to be submitted to the newly founded United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) can perhaps be interpreted as an attempt by Washington and London, as the only two Western nuclear powers at the time, to shape UNSCEAR's views on fallout in their favour so that the two nations' nuclear testing programmes could go ahead with minimal interference. Out of growing awareness of fallout from nuclear testing, the United Nations (UN) general assembly had agreed in December 1955 to form UNSCEAR to study the effects of ionizing radiation on public health and the environment.⁷⁷

In March 1955, Willard F. Libby had already published an article in *The United States and World News* magazine that offered a very optimistic assessment of the potential hazards that fallout posed to human health and the environment, bordering on the mitigation of fears of fallout. *The Times* consequently referred to Libby's piece as 'an attempt to counteract what is described as the "intensive campaign to generate fear of A-bomb tests" in America and elsewhere'.⁷⁸ But, when a few months later more alarming details about the spread of fallout from the Castle-Bravo test emerged, such fears appeared to be substantiated.⁷⁹ And this led the *Bulletin of the Atomic Scientists*, for example, to dedicate an issue to the study of genetic effects of nuclear weapons and testing.⁸⁰

UNSCEAR did not mark the only instance where Whitehall gave special consideration to Washington's viewpoints. British government agencies also frequently consulted and monitored American publications on fallout, particularly strontium-90.⁸¹ Cabinet members were concerned over the United States government's position on fallout for several reasons. Above all, Whitehall attempted to avoid upsetting the Eisenhower administration because the McMahon Act, which prohibited the sharing of American nuclear information with foreign governments since 1946 and which the

⁷⁷ Lloyd, 'Cabinet: nuclear tests', p. 1; Salisbury, 'Cabinet: nuclear and allied radiations', pp. 1–2, TNA, CAB 129/81; Willard F. Libby, 'Radioactive strontium fallout', *Proceedings of the National Academy of Sciences of the United States of America*, 42 (1956), pp. 365–90; United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), 'Report of the UNSCEAR', general assembly: thirteenth session, supplement no. 17 (A/3838), New York, NY, 1958, p. 1.

⁷⁸ Willard F. Libby, 'The facts about A-bomb fallout', *United States News and World Report*, 25 Mar. 1955, pp. 21–6; 'Atomic tests aftermath', *Times*, 22 Mar. 1955, p. 6.

⁷⁹ Ralph E. Lapp, 'Radioactive fall-out', *BAS*, 11 (1955), pp. 206–9; 'Triple atomic bomb', *Times*, 14 June 1955, p. 6.

⁸⁰ Eugene Rabinowitch, 'Editorial', *BAS*, 11 (1955), pp. 314–16, 343.

⁸¹ 'A report by the United States Atomic Energy Commission on the effects of high-yield nuclear explosions', 5 Feb. 1955, p. 8; Home Office, Civil Defence Department, Intelligence Branch, 'CD information bulletin no. 1/1955. subject: publicity given in the United States of America to radioactive fall-out', 14 Jan. 1955, pp. 1–2; Robertson to Strath, 4 Jan. 1955, all in TNA, CAB 21/4053; Arnold, *Britain and the H-bomb*, p. 112; Hughes, 'Strath report', pp. 263, 269.

British government tried so desperately to have removed, was still in effect.⁸² Moreover, the sovereignty of Christmas Island, where the British thermonuclear tests were to be staged in 1957, was still in dispute between Britain and the United States.⁸³ The fact that Adlai Stevenson, the Democratic party's contender in the 1956 United States presidential elections, made fallout an issue in his campaign, calling for a moratorium on nuclear testing, focused publicity on the matter, thus further complicating the situation for the British government.⁸⁴

IV

British government policy and declarations on nuclear weapons effects, especially the 1956 MRC report, provided a crucial impetus for further mobilizing scientists, and ultimately the public, in the fallout debate. For the MRC's findings prompted Joseph Rotblat to propose to senior ASA officers that the association release a statement on the effects of fallout from H-bomb tests. At a meeting of the ASA's governing council in early February 1957, Rotblat stressed that 'the fallout hazard cannot be ignored, even from current tests'. He pointed to activities by scientists in the United States as an attainable model to be followed by the ASA. Here, Rotblat referred to the FAS and the *Bulletin of the Atomic Scientists*' criticism of the Eisenhower administration for continuing with its thermonuclear testing programme and for playing down the consequences of fallout through official statements such as Willard F. Libby's aforementioned report.⁸⁵

Rotblat's call for action elicited a mixed response from ASA council members, revealing serious limitations to the organization's effectiveness. This paralysis was chiefly the result of the association's ambiguous entanglement with the British government, in particular through several members who sat on the MRC's Committee on the Hazards of Nuclear Radiation (Haddow and Penrose) and, in the cases of Himsforth and Cockcroft, were at the same time also government employees. During internal debates of the planned statement within the ASA council, Sir George Thomson wrote that he 'must protest most strongly against' the proposed report, arguing that the conclusions of the 1956 MRC report made an ASA statement on the subject superfluous and that the association should generally abstain from making

⁸² Simon J. Ball, 'Military nuclear relations between the United States and Great Britain under the terms of the McMahon Act, 1946–1958', *Historical Journal*, 38 (1995), pp. 439–54; Septimus H. Paul, *Nuclear rivals: Anglo-American relations, 1941–1952* (Columbus, OH, 2000), pp. 94–5.

⁸³ Lloyd, 'Cabinet: nuclear tests', p. 1.

⁸⁴ Brook, 'Cabinet minutes, CM (56) 40th meeting (7 June 1956)'; Michael Egan, *Barry Commoner and the science of survival: the remaking of American environmentalism* (Cambridge, MA, 2007), p. 52; Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate*, p. 5.

⁸⁵ Allen, 'Minutes of the 87th council meeting', p. 3, RTBT, K. 124; Egan, *Barry Commoner*, p. 65.

political statements.⁸⁶ Similarly, Sir John Cockcroft, a member of the MRC committee, argued, ‘the A.S.A. should confine itself to scientific matters and publicising the facts’, adding: ‘So far as I know the facts as stated in the report of the Medical Research Council still hold.’⁸⁷ By contrast, Alexander Haddow and Lionel Sharples Penrose, who had also served on the MRC committee, now sat on Rotblat’s ASA committee.⁸⁸ Haddow’s case was peculiar in that he had publicly spoken out in favour of a multilateral nuclear test stop in 1955 in connection with his appointment to the MRC committee. While Haddow stressed the importance of the MRC committee’s work and similar efforts by the National Academy of Sciences in the United States as well as ‘the free availability and review of all existing information...and...the acquisition of new knowledge by research’, he declared: ‘I give it as my conviction that existing knowledge is already adequate to determine at least a humane policy, and to encourage us to press for the prohibition of test explosions’ under some form of multilateral agreement.⁸⁹

Since there was ‘an almost unanimous opinion’ in the ASA council ‘that the A.S.A. should issue a statement on the scientific problems concerning radiation hazards, but not on the political aspect’, as ASA secretary H. R. Allan informed council members, the Committee on Radiation Hazards drafted a report based on its findings under Rotblat’s directorship.⁹⁰ Given that some ASA council members such as Sir John Cockcroft and Sir Harold Himsworth worked for the British government, the ASA liaised with the United Kingdom Atomic Energy Authority (UKAEA) about the content of the statement ahead of its release. Since the report ‘may cause embarrassment to the Government’, as an ASA officer explained this move, assuring the UKAEA that the report was to ‘be redrafted in such a way that the controversial part...is attributed to the expert committee set up by the A.S.A. rather than to Council itself’.⁹¹ Eventually, the ASA council decided to publish the document in the name of Rotblat’s group and distributed it to government and press offices, including the Foreign Office (FO), the Ministry of Health, and the prime minister.⁹²

In the ‘Statement on strontium hazards’ of April 1957, Rotblat’s committee offered a corrective to the findings of the 1956 MRC report. Where strontium-90 fallout from nuclear testing represented only one of many aspects covered in

⁸⁶ Thomson to Allen, 15 Feb. 1957, RTBT, K. 124.

⁸⁷ Cockcroft to Allan, 11 Mar. 1957, TNA, AB 27/6.

⁸⁸ Allan to vice-presidents and members of the council, 1 Apr. 1957, TNA, AB 27/6.

⁸⁹ Alexander Haddow, ‘The problem before mankind’, in Gilbert McAllister, ed., *The bomb: challenge and answer* (London, 1955), pp. 15–45, at pp. 31–2. For a comparative analysis of the work of the MRC and the National Academy of Sciences in the United States, see Higuchi, ‘Radioactive fallout’, pp. 137–66.

⁹⁰ Allan to vice-presidents and members of the council, 1 Apr. 1957, TNA, AB 27/6.

⁹¹ Fishenden to Schonland, 4 Apr. 1957, TNA, AB 27/6.

⁹² Matterson to Schonland, 16 Apr. 1957, TNA, AB 27/6; Allan to Press Office, Foreign Office, 15 Apr. 1957, TNA, FO 371/129239; Allen to Press Office, Ministry of Health, 15 Apr. 1957; Allen to private secretary to the prime minister, 15 Apr. 1957, all in RTBT, K. 117.

the MRC's 128-page report, the two-page 'Statement on strontium hazards' solely focused on this radioactive isotope. Based on additional information that had come to light since the release of the MRC report, the Committee on Radiation Hazards specifically warned of the hazards that internal radiation through strontium-90 posed to human health. Acknowledging limitations in the available knowledge of health and environmental effects from fallout, the two bodies mainly disagreed over the data and method of analysis, in particular the existence of a so-called threshold dose below which radiation is supposedly harmless.⁹³ In this, they addressed what J. Christopher Jolly identifies as 'the central scientific question of the fallout debate – a question that has yet to be resolved'.⁹⁴

The Committee on Radiation Hazards picked up on one particular point raised in the MRC report that concerned the cumulative dose received as a result of exposure of human reproductive organs to fallout from nuclear testing. Himsworth's committee calculated this conservatively at a rate of below 1 per cent of the naturally occurring radiation.⁹⁵ Rotblat's ASA committee, by contrast, pointed to strontium-90 fallout as a far greater danger to future generations than exposure of reproductive organs to radioactive residue from nuclear testing. Here, the Committee on Radiation Hazards focused on 'the long lived radioactive products' of nuclear tests, in particular small doses of strontium-90, that only 'gradually descend to the ground over a period of some years' and collect in human bones where they subsequently lodge for long periods. Rotblat's group concluded 'that by the year 1970 the radiation dose to bone from all the tests carried out up to the autumn of 1956 will range from 9 per cent. to 45 per cent. of the dose received from all natural sources, including the radium which is normally present in the bone'. While they recognized the uncertainty about the precise nature of the harmful effects that low doses of strontium-90 accumulating in the human body might produce, Rotblat and his team attempted to establish a correlation between individual H-bomb tests and rising bone cancer rates worldwide. 'The calculations given', they argued, 'show that an H-bomb of the type tested at Bikini in 1954, if exploded high in the atmosphere, may eventually produce bone cancers in 1,000 people for every million tons of TNT of equivalent explosive power', with approximately '50 million tons' already detonated up to that point.⁹⁶

⁹³ Massey and Allen, 'H-bomb tests', pp. 39–40; Cmd 9780, MRC, *The hazards to man of nuclear and allied radiations*, pp. 57–8; Salisbury, 'Cabinet: nuclear and allied radiations', pp. 80–1. See also John Lear, 'Where is the rest of the strontium-90?', *New Scientist*, 29 Nov. 1956, pp. 29–30.

⁹⁴ J. Christopher Jolly, 'Linus Pauling and the scientific debate over fallout hazards', *Endeavour*, 26 (2002), pp. 149–53, at p. 151.

⁹⁵ Cmd 9780, MRC, *The hazards to man of nuclear and allied radiations*, pp. 58–9. Note that the 'Statement on strontium hazards' words this cautiously as 'to be of the order of 1 per cent.', Massey and Allen, 'H-bomb tests', p. 39.

⁹⁶ Massey and Allen, 'H-bomb tests', pp. 39–40.

Reception of the statement varied considerably. The national news media paid particular attention to the link between small doses of strontium-90 fallout from thermonuclear testing and cancer that Rotblat's committee had attempted to establish.⁹⁷ But this linear relationship also generated controversy amongst ASA council members. After all, it was one of the chief reasons behind the decision to publish the 'Statement on strontium hazards' in the name of Rotblat's committee and not the association. Apart from Sir George Thomson's aforementioned criticism of the report, Sir John Cockcroft, who had been involved in drafting the 1956 MRC report, Rudolf Peierls, and Herbert Skinner rejected claims that such a link existed during internal debates of the draft report prior to its publication.⁹⁸ In Cockcroft's and Himsworth's cases, the release of the 'Statement on strontium hazards' marked a loyalty clash between their roles as government employees, on the one hand, and their engagement as concerned and socially responsible scientists in the ASA, on the other. Cockcroft felt compelled to distance himself and other ASA council members who were in government employment from the statement in a letter to the UKAEA chairman Sir Edwin Plowden, emphasizing that the report only represented the views of the Committee on Radiation Hazards. 'This letter arose from the fact that since a number of members of Harwell staff are members of the Association and several others including Himsworth, our Vice President [sic], we could not be officially associated with any such statement', Cockcroft wrote, stressing: 'This appeared the best we could do.'⁹⁹ Himsworth, who faced a similar dilemma owing to his senior roles in the MRC and the ASA, rejected the report outright. He even contacted Cockcroft immediately after its release 'to discuss action' that they both 'should take as a result of the A.S.A. statement', in particular with regards to 'the question of possible resignation from the A.S.A.'¹⁰⁰ Cockcroft informed ASA president Harrie Massey that he felt 'somewhat embarrass[ed]' because 'the *Manchester Guardian* and other papers...formally associated my name with the statement in spite of the fact that it was issued as a statement of the Committee'.¹⁰¹ Massey, who was himself 'somewhat disturbed by the recent statement', shared Cockcroft's concerns and subsequently even resigned the association's presidency.¹⁰²

While the release of the 'Statement on strontium hazards' led to loyalty clashes in some ASA council members and to the resignation of its president, the study also triggered a strong response from some government offices, in

⁹⁷ 'Strontium risks from bombs', *Times*, 17 Apr. 1957, p. 7; 'Bone and bone cancer', *Manchester Guardian*, 18 Apr. 1957, p. 8; "'Fall-out'", *ILN*, 22 June 1957, pp. 1020–1, at p. 1020.

⁹⁸ Cockcroft to Allan, 5 Apr. 1957, TNA, 27/6; Peierls to Allan, 8 Apr. 1957, RTBT, K. 124; Skinner to Allan, 10 Apr. 1957, RTBT, K. 124.

⁹⁹ Cockcroft to Plowden, 16 Apr. 1957, TNA, AB 27/6.

¹⁰⁰ Note, 25 Apr. 1957, TNA, AB 26/7.

¹⁰¹ Cockcroft to Massey, 2 May 1957, TNA, AB 27/6; 'Bone and bone cancer', p. 8.

¹⁰² Massey to Cockcroft, 6 May 1957, TNA, AB 27/6.

particular the foreign secretary. During a BBC radio programme on the hydrogen bomb, Selwyn Lloyd attempted to discredit members of Rotblat's committee as "people with strong fellow travelling tendencies and leanings", a claim Rotblat vehemently denied.¹⁰³ Rotblat had given the first talk in a series of three broadcasts on thermonuclear weapons on the BBC's Light channel 'Women's hour' programme that was followed by Lionel Sharples Penrose and Lloyd.¹⁰⁴ Once the foreign secretary had accepted the invitation to appear on the show, FO staff had started to gather information about the political leanings of the two ASA members who were also set to speak on the programme. According to an internal minute, Rotblat was 'known for his very strong opposition to the manufacture of nuclear weapons'. The same document characterized Penrose as 'a well-known supporter of front organisations', explaining that 'for that reason [he] was not chosen by the M.R.C. to be the genetics adviser to the U.N. Radiation Conference Delegation'.¹⁰⁵ Similarly, Ministry of Defence staff with whom FO personnel liaised over the appearance of the two ASA members on the radio programme, stated they were 'disconcerted to hear of the intention for Dr. Rotblat to broadcast before our tests', as 'it hardly seems necessary for "impartiality" to be carried to these lengths'.¹⁰⁶

After the foreign secretary had made his controversial remark, FO staff attempted to analyse its possible impact and prepared an exit strategy for Lloyd to avoid any damage to his and the Macmillan government's reputation.¹⁰⁷ During this process, FO personnel contacted the Security Service (Military Intelligence, Section 5; MI5) regarding Penrose's and Rotblat's political affiliations. While MI5 attested Rotblat, whom they had become interested in after his name had appeared amongst the signatories of the 'Russell-Einstein manifesto' in 1955, 'a clean bill of health', they accused Penrose of 'a long record of fellow-travelling activities'.¹⁰⁸ Finally, Lloyd apologized to Rotblat.¹⁰⁹ Although the fellow-traveller episode had thus officially been concluded, the FO remained concerned about possible bad publicity and denied the BBC – by official definition independent from government interference – clearance to read listeners' letters of complaint about the foreign secretary's statement on air.¹¹⁰

¹⁰³ Rotblat to Lloyd, 1 May 1957; H. Hainworth, note, 7 May 1957, both in TNA, FO 371/129241.

¹⁰⁴ Ian Harvey, 'The H-bomb – B.B.C. broadcasts', [21 Mar.] 1957, TNA, FO 371/129239.

¹⁰⁵ G. Brown, minute, 2 Apr. 1957, TNA, FO 371/129241.

¹⁰⁶ G. Brown, 'Broadcasts on nuclear problems', 10 Apr. 1957, TNA, FO 371/129241.

¹⁰⁷ Laskey to Langridge and Permanent Under-Secretary's Department, 5 May 1957; H. Hainworth, note, 7 May 1957. This even included drafting both a precautionary parliamentary question and answer: J. C. Cloake, note, 9 May 1957; 'Draft parliamentary question' and 'Draft answer', attached to H. Hainworth, note, 9 May 1957, all in TNA, FO 371/129241.

¹⁰⁸ A. E. Davidson, note, 8 May 1957, TNA, FO 371/129241.

¹⁰⁹ Lloyd to Rotblat, 13 May 1957, TNA, FO 371/129241.

¹¹⁰ Anthony Adamthwaite, "'Nation shall speak peace unto nation": the BBC's response to peace and defence issues, 1945–1958', *Contemporary Record*, 7 (1993), pp. 557–77, at p. 561.

The 'Statement on strontium hazards' represented a rare case where the ASA and British government offices openly clashed. In fact, this confrontation appears ironic, given that the ASA liaised with the UKAEA over the report ahead of its launch in line with its generally non-confrontational course towards the government. This policy lay partly rooted in the ASA's ambiguous 'objective' approach to political issues. And this is where the ASA's institutional approach differed from that of individual ASA members such as Patrick Blackett or other intellectuals such as philosopher Bertrand Russell, who seemed to fit more closely the stereotype of the morally responsible scientist and scholar respectively. In this, they formed part of a tradition of how British intellectuals have often viewed themselves as 'public moralists' since the nineteenth century.¹¹¹ Despite the ASA's continued efforts not to upset the government, flashpoints existed in the relationship between the ASA and the government with regards to different interpretations of the concept of national security, especially conflicting opinions on the significance of the free flow of scientific information. As early as October 1946, the ASA had publicly criticized the secrecy clause in the new British Atomic Energy Act as being counterproductive to basic research.¹¹² On another occasion, the ASA clashed with the government over a secret purge of political radicals in the British civil service that the Attlee government introduced in 1948.¹¹³

Foreign governments and non-government organizations, by contrast, appeared to be more amenable to the Committee on Radiation Hazards' findings than British government offices.¹¹⁴ The Belgian, Japanese, and West German governments, the UN, the FAS, the West German Max-Planck Institute for Biophysics, as well as the United Free Church and the Rockefeller Institute for Medical Research (both in the United States), showed interest in the report.¹¹⁵ The 'Statement on strontium hazards' also received exposure in the American news and scientific press. *The New York Times*, for example, dedicated an article to the report, focusing on the proposed linear connection between hydrogen bomb tests and cancer.¹¹⁶ Since nuclear testing and its effects on public health, in the words of its editor Eugene Rabinowitch, 'continue[d] to stir public opinion throughout the world', the *Bulletin of the Atomic Scientists* reprinted the ASA statement in June 1957 as part of a section on

¹¹¹ Stefan Collini, *Public moralists: political thought and intellectual life in Britain, 1850–1930* (Oxford, 1991). Patrick Blackett published his critique of British nuclear policy, for example, in the form of *Military and political consequences of atomic energy* (London, 1948). On Russell, see Ivor Grattan-Guinness, 'Bertrand Russell (1872–1970): man of dissent', *Notes and Records of the Royal Society*, 63 (2009), pp. 365–79.

¹¹² Philip Moon and Rudolf Peierls, 'Atomic energy: second reading of the bill, two points of criticism', *Times*, 8 Oct. 1946, p. 5.

¹¹³ 'The civil service purge', *ASN*, 3 (1950), pp. 108–9.

¹¹⁴ 'Strontium risks from bombs', 7.

¹¹⁵ See correspondence in RTBT, K. 127.

¹¹⁶ 'Bone cancer link to H-bomb feared', *New York Times*, 17 Apr. 1957, p. 3.

'The nuclear weapon test ban' alongside Albert Schweitzer's 'Appeal to end nuclear tests' and Willard F. Libby's reply to the latter.¹¹⁷

The topicality of the fallout issue around the time of the ASA report's publication was a chief reason for its wide reception. Above all, its message resonated with public opinion. Between October 1957 and 1958, the hydrogen bomb ranked amongst the British government's top five 'Most urgent problem[s]' in several opinion surveys. In two Gallup polls conducted in April and May 1957, a majority of respondents considered scientists' cautioning about the effects of nuclear tests on human health to be 'well founded' (54 per cent and 59 per cent respectively).¹¹⁸ The national and international scientific and popular press also covered the fallout issue in depth. Britain's world-leading scientific journal *Nature* addressed fallout, especially strontium-90,¹¹⁹ and the American *Life* magazine investigated 'nuclear perils' in relation to thermonuclear testing.¹²⁰ The American scientists J. Laurence Kulp, Walter R. Eckelmann, and Arthur R. Schulert had also published the first comprehensive assessment of strontium-90 concentration in humans only some two months prior to the release of the 'Statement on strontium hazards', casting some doubt on the conclusions reached by the MRC in its 1956 report.¹²¹ By September 1957, American scientists associated with Barry Commoner, Edward U. Condon, and Linus Pauling publicly followed a similar line of investigation as Rotblat's Committee on Radiation Hazards and warned that further nuclear explosions would lead to an increase in genetic mutations, calling for a test cessation.¹²² Early in the following year, a group of Japanese physicists urged ASA members to support their campaign against the planned British H-bomb tests in the Pacific to avert additional atmospheric contamination through strontium-90.¹²³

¹¹⁷ Eugene Rabinowitch, 'The nuclear weapon test ban', *BAS*, 13 (1957), p. 201; ASA, 'Strontium hazard', *BAS*, 13 (1957), pp. 202–3; Albert Schweitzer, 'Appeal to end nuclear tests', *BAS*, 13 (1957), pp. 204–5; Willard F. Libby, 'A letter from Dr. Libby', *BAS*, 13 (1957), pp. 206–7.

¹¹⁸ Gallup, ed., *Gallup international public opinion polls*, 1, pp. 409, 411, 430, 442, 458, 465–6, 480, 482, 487.

¹¹⁹ See, for example, Herman M. Kalckar, 'An international milk teeth radiation census', *Nature*, 182 (1958), pp. 283–4; R. Scott Russell, 'Deposition of strontium-90 and its content in vegetation and in human diet in the United Kingdom', *Nature*, 182 (1958), pp. 834–9.

¹²⁰ Thomas E. Murray, 'Reliance on H-bomb and its dangers', *Life*, 6 May 1957, pp. 181–2, 184, 187–8, 193–4, 197–8, at pp. 188, 193; 'A searching inquiry into nuclear perils', *Life*, 10 June 1957, pp. 24–9, at p. 27.

¹²¹ J. Laurence Kulp, Walter R. Eckmann, and Arthur R. Schulert, 'Strontium-90 in man', *Science*, 125 (1957), p. 224.

¹²² 'An appeal by American scientists to the governments and the people of the world', *BAS*, 13 (1957), p. 264. See also Walter Selove and Mortimer Elkind, eds., *Radiation and man*, spec. issue of *BAS*, 14 (1958).

¹²³ 'Appeal to the British physicists against hydrogen-bomb testing by the undersigned Japanese physicists', 28 Feb. 1958, attached to letter, Fujimato to Rotblat, 1 Mar. 1957, RTBT, K. 125; 'Peace is on...their minds', *Picture Post*, 18 Mar. 1957, p. 5; 'Telegrams', *Picture Post*, 27 Apr. 1957, p. 5.

The year the ASA published the 'Statement on strontium hazards' also saw popular protests against nuclear testing in Britain gain momentum. The National Council for the Abolition of Nuclear Weapons Tests (NCANWT) and the Direct Action Committee against Nuclear War (DAC), two key forerunner organizations of CND, mounted events such as the NCANWT's 'Women's protest march against H-bomb tests' in London.¹²⁴ Public opinion survey data, however, demonstrates that the representativeness of these groups' actions and views should not be overprivileged. As in the case of Whitehall's decision to develop atomic and thermonuclear arms, national security concerns figured high in respondents' views on nuclear testing: 45 per cent of respondents to a Gallup poll in May 1957 approved of the planned British thermonuclear tests (with 39 per cent disapproving and 16 per cent not knowing). While there appeared to be widespread support for multilateral nuclear disarmament and an end to testing, Britons seemed to be taken in much less by the idea of British unilateralism in these two realms. This differentiation between fallout and the nuclear arms race as global issues, on the one hand, and British national security interests, on the other, remained an important feature of British public opinion. Not only did a majority of respondents to a Gallup poll in February 1958 disapprove of both unilateral British nuclear disarmament (58 per cent) and the complete end to British thermonuclear testing (52 per cent), but 46 per cent also stated that a cessation in testing should be treated 'as [a] separate issue' from nuclear disarmament altogether. A Gallup poll in October 1957 even reveals a relatively high level of apathy towards British thermonuclear testing, underlining the fact that the NCANWT and the DAC represented minority views.¹²⁵

Nevertheless, the fallout issue ranked high on the political agenda, and the 'Statement on strontium hazards' came up during several debates in the House of Commons.¹²⁶ Here, the ASA report often exposed a deep rift between proponents of the official government line and those who cited the findings of Rotblat's ASA committee as evidence of the harmful effects of fallout from nuclear testing. Although the British government recognized the importance of the test ban debate by the summer of 1957, especially with a view to the 1959 general election, several factors still affected British national security interests at this point and did not yet allow the government to push more actively for a nuclear test ban. Particularly with the MacMahon Act still cutting the country off from American nuclear know-how and a British thermonuclear deterrent not yet available, the Macmillan government deemed the completion of a series of nuclear tests in 1957–8 vital to British national security interests.¹²⁷ In addition, the increasing likelihood of a moratorium on nuclear

¹²⁴ Jill Liddington, *The road to Greenham Common: feminism and anti-militarism in Britain since 1820* (Syracuse, NY, 1991), pp. 187–8; Taylor, *Against the bomb*, pp. 5–18, 115, 122.

¹²⁵ Gallup, ed., *Gallup international public opinion polls*, 1, pp. 363, 411–12, 449–50, 453–4, 476, 479, 483.

¹²⁶ *Parliamentary debates* (Commons), vol. 569, 3 May 1957, cols. 598–608.

¹²⁷ Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate*, pp. 6–7.

tests in the near future made these trials a matter of utmost urgency to ensure Britain acquired working thermonuclear weapons before a test ban came into force.¹²⁸ Hence, cabinet members frequently rebuked proposals that called for a review of government policies on nuclear testing in light of the 'Statement on strontium hazards'. Instead, they insisted upon the correctness of the MRC's conclusions and rejected the ASA's findings.¹²⁹

During a House of Commons debate on 17 April 1957, for example, MP Barbara Castle (Labour) cited the ASA's 'Statement on strontium hazards' as scientific proof of the potentially harmful impact of radioactive fallout on human health and the environment, calling on the government to abandon the planned thermonuclear tests. In response to such demands, Prime Minister Harold Macmillan reassured MPs 'that there really was no risk' of radioactive contamination of the food chain through fallout from thermonuclear testing.¹³⁰ In another debate, in the House of Commons on 7 May 1957, on the upcoming British hydrogen bomb trials, the home secretary and lord privy seal, Richard Butler, declined several MPs' calls for suspending the H-bomb tests on grounds of national security interests, cast the accuracy of the ASA's statement into doubt, and rejected the request of Hugh Gaitskell (Labour) for a new MRC report on fallout. Furthermore, Butler rebuffed a plea to hold an international conference on the fallout issue and attempted to defuse concerns over heightened levels of strontium-90 recorded in the Welsh mountains.¹³¹

These House of Commons debates suggest a united opposition. But the Labour party was in fact divided over nuclear disarmament. While Barbara Castle, like Tony Benn, Frank Cousins, and Judith Hart, belonged to a group of Labour MPs around Aneurin Bevan on the party's left wing that called for unilateral British nuclear disarmament, Gaitskell represented the party's right-wing leadership that opposed such moves. Tensions increased at Labour's annual conference in Brighton in October 1957 when the party's national executive committee under Gaitskell's directorship rejected a motion by delegates to accept a resolution for unilateral nuclear disarmament, and Bevan flip-flopped in his position, now arguing against a unilateralist approach based on reasons of national security and prestige. Finally, friction within the Labour party peaked at the 1960 party annual conference when its leadership was defeated outright.¹³²

¹²⁸ Arnold, *Britain and the H-bomb*, pp. 115–19, 131–50; Walker, *British nuclear weapons*, pp. 91–107.

¹²⁹ *Parliamentary debates* (Commons) vol. 568, 17 Apr. 1957, cols. 1922–3; *Parliamentary debates* (Commons) vol. 570, 13 May 1957, cols. 31–2.

¹³⁰ *Parliamentary debates* (Commons), vol. 568, 17 Apr. 1957, cols. 1907–8, 1920–2.

¹³¹ 'Did H-dust land here?', *Daily Mirror*, 9 May 1957, p. 1; 'Nuclear tests'; *Parliamentary debates* (Commons) vol. 569, 7 May 1957, cols. 799–803. See also Western Mail, *Strontium 90 in Wales: a series of articles reprinted from the Western Mail* (Cardiff, [c. 1958]).

¹³² Richard Taylor, 'The Labour party and CND: 1957 to 1984', in Richard Taylor and Nigel Young, eds., *Campaigns for peace: British peace movements in the twentieth century* (Manchester, 1987), pp. 100–30, at pp. 101–16.

By 1958, Whitehall's decision to push ahead with a series of nuclear and thermonuclear tests had become increasingly unpopular and met with growing opposition. Perhaps most notably, CND came into existence and played a chief role in organizing the first Aldermaston march on Easter 1958.¹³³ In May of the same year, CND's Hampstead branch launched its 'No place to hide' exhibition that addressed the effects of nuclear weapons and testing, making the national news.¹³⁴ But protests against thermonuclear testing also spread geographically further afield to such remote towns as Merthyr Tydfil in south Wales, where the mayor and the local trades council organized a march against H-bomb trials.¹³⁵ At this point, public opinion on unilateral nuclear disarmament also softened as a result of the Soviet Union's announcement, a few weeks earlier, of its decision to stop testing. In May 1958, 43 per cent of respondents to a Gallup poll agreed that Britain and the United States '[s]hould stop now' with their nuclear tests, and 19 per cent stated they '[s]hould stop after present tests completed' (28 per cent opposed such a bilateral cessation, while 10 per cent were undecided).¹³⁶

Since the Soviets proclaimed their unilateral action only after they had completed a series of trials to put pressure on the United States and Britain, Harold Macmillan and President Eisenhower viewed this move with suspicion.¹³⁷ In addition, Britain had not yet completed its series of H-bomb tests – the main prerequisite for achieving thermonuclear power status. Since the McMahon Act was also still in effect, the British government was dependent on conducting these trials in the absence of available American nuclear data and in the interest of British national security.¹³⁸ And this helps to explain why Macmillan, for example, declined an appeal by Bertrand Russell and 618 scientists to end British nuclear testing in May 1958.¹³⁹

This international framework and the prioritization of national security concerns, along with the still fairly limited knowledge of the environmental and public health implications of nuclear fallout, also account in part for the way in which the government handled a fire in one of the reactors at Windscale, Cumbria, in October 1957.¹⁴⁰ The world's first major reactor accident sharpened public awareness about the environmental and health risks of peaceful

¹³³ Taylor, *Against the bomb*, pp. 28–9.

¹³⁴ '46 grim lessons of nuclear war', *Times*, 27 May 1958, p. 11.

¹³⁵ The Mayor and Merthyr Trades Council, 'An appeal to sanity', n.d. [c. 1958], Richard Burton Archives, Swansea University, Swansea, Wales, United Kingdom, South Wales Coalfield Collection, SC 54.

¹³⁶ Divine, *Blowing on the wind*, pp. 200–1; Gallup, ed., *Gallup international public opinion polls*, 1, p. 463.

¹³⁷ Divine, *Blowing on the wind*, pp. 200–1.

¹³⁸ Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate*, p. 7.

¹³⁹ "'Lone declaration to suspend bomb tests of little value'", *Times*, 2 May 1958, p. 5; 'Premier rejects suspension', *Manchester Guardian*, 2 May 1958, p. 1.

¹⁴⁰ Arnold, *Windscale 1957*, pp. xxi, 42–59.

atomic power,¹⁴¹ and Windscale received broad coverage in the popular and scientific press.¹⁴² Several months later, the *Daily Mirror*, for example, still reported on '[t]he atomic cloud that appeared over London after the accident'. The article also established a link between fallout from Windscale and nuclear testing but cited the MRC's 1956 report to reassure readers that any health risks from nuclear testing were negligible.¹⁴³ And this illuminates two key points: the interconnectedness of Britain's peaceful and military nuclear programmes and the extent to which Whitehall attempted (and in fact managed) to control the public discourse over nuclear fallout. Given that the reactor produced both electricity for the national grid and plutonium for Britain's nuclear weapons project, Lorna Arnold rightly argues, '[t]he 1957 Windscale fire went to the very heart of Britain's defence programme'.¹⁴⁴

While knowledge of environmental and health effects from fallout, in particular low doses of isotopes with a long half-life such as strontium-90, was still far from comprehensive around the time of the Windscale fire, government offices, nevertheless, played down the consequences of the accident in order not to jeopardize the existence of Britain's nuclear deterrent. William Penney, who was a veteran scientist of the Manhattan Project and in charge of developing nuclear weapons for the UKAEA, headed the official government investigation into the Windscale incident. The resulting report concluded that sufficient measures had been taken after the reactor fire and considered the likelihood of any health and environmental effects of the accident to be very low.¹⁴⁵ Directed by Sir Harold Himsworth, the MRC also participated in the inquiry. In November 1957, Himsworth declared in the House of Commons 'that it is in the highest degree unlikely that any harm has been done to the health of anybody, whether a worker in the Windscale plant or a member of the general public'.¹⁴⁶ On the impact of strontium-90 emissions more specifically, he surmised that 'the magnitude of this contribution could be of no significance to health'.¹⁴⁷ Himsworth's assessment of the consequences of the

¹⁴¹ Jones, 'Mushroom-shaped cloud', p. 19.

¹⁴² "'Death dust" scare at A-plant', *Daily Mirror*, 12 Oct. 1957, p. 1; "'A-milk'", *Daily Mirror*, 15 Oct. 1957, p. 3; 'Uneasiness at Calder Hall', *Times*, 17 Oct. 1957, p. 2; 'Fall-out at Windscale', *Economist*, 19 Oct. 1957, pp. 1, 239–41; A. C. Chamberlain and H. J. Dunster, 'Deposition of radioactivity in north-west England from the accident at Windscale', *Nature*, 182 (1958), pp. 629–30; N. G. Stewart and R. N. Crooks, 'Long-range travel of the radioactive cloud from the accident at Windscale', *Nature*, 182 (1958), pp. 627–8; G. Maycock and J. Vennart, 'Iodine-131 in human thyroids following the Windscale reactor accident', *Nature*, 183 (1958), p. 1545; 'After Windscale', *New Scientist*, 24 Oct. 1957, p. 7.

¹⁴³ Ronald Bedford, 'The atomic cloud over Britain', *Daily Mirror*, 11 Mar. 1958, p. 9.

¹⁴⁴ Arnold, *Windscale 1957*, p. xxi.

¹⁴⁵ *Ibid.*, pp. 78–9; Brian Cathcart, 'Penney, William George, Baron Penney (1909–1991)', *ODNB*.

¹⁴⁶ Cmnd 302, *Accident at Windscale no. 1 pile on 10th October, 1957: presented to parliament by the prime minister by command of Her Majesty, November 1957* (London, 1957), p. 20.

¹⁴⁷ Harold P. Himsworth, 'Annex III: Medical Research Council, report by the Committee on the Health and Safety Aspects', in *ibid.*, p. 18.

Windscale fire thus appears to mark a step back from the MRC's relatively open acknowledgement of possible effects of fallout in the 1956 report.

However, this evaluation of the health and environmental impact of radiation from the Windscale fire did not go unchallenged within Macmillan's cabinet. John Hare, the minister of agriculture, fisheries, and food, was deeply frustrated with Himsworth's management of the environmental and health consequences of the Windscale fire. Consequently, he urged Macmillan in September 1958 to inform the public about the high levels of strontium-90 on farmland around the Windscale site.¹⁴⁸ Hare's move demonstrates once again the subtleties of British government positions on fallout.

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By autumn 1958, the debate over the environmental and health effects of fallout had thus caused open controversy amongst members of Macmillan's cabinet. A few years later, Sir Solly Zuckerman, the chief scientific adviser to the Ministry of Defence from 1960, followed a similar course to Hare's and openly warned against the effects of the H-bomb.¹⁴⁹ Simultaneously, an anti-nuclear weapons mass movement formed and staged its first Aldermaston march on Easter 1958. Despite these developments, public opinion on fallout and nuclear testing was ambiguous: while the debate over effects of nuclear testing demonstrates that 'the Cold War nuclear project enabled a new vision of the planet as an integrated biosphere', as Joseph Masco observes elsewhere,¹⁵⁰ British public opinion generally opposed British unilateral action in nuclear disarmament and stopping nuclear testing based on national security considerations. Fallout and its effects on health and the environment remained in the public eye into the early 1960s, especially after the end of the moratorium on nuclear trials and a Soviet test of a 50-megaton H-bomb in October 1961.¹⁵¹

¹⁴⁸ John Hare, memorandum for prime minister, 12 Sept. 1958; John Hare, memorandum for prime minister, 24 Oct. 1958; John Hare, memorandum for prime minister, 14 Nov. 1958, all in TNA, PREM 11/2540.

¹⁴⁹ Richard Maguire, 'Scientific dissent amid the United Kingdom government's nuclear weapons programme', *History Workshop Journal*, 63 (2007), pp. 113–35.

¹⁵⁰ Joseph Masco, 'Bad weather: on planetary crisis', *Social Studies of Science*, 40 (2010), pp. 7–40, at p. 9.

¹⁵¹ See, for example, William Greig, 'Death dust has doubled', *Daily Mirror*, 28 Apr. 1959, p. 1; Ronald Bedford, 'The death rate and atom-dust by a doctor', *Daily Mirror*, 23 Oct. 1959, pp. 16–17; 'More strontium 90 in children', *Times*, 22 Mar. 1960, p. 9; Ronald Bedford, 'More A-dust...fall-out tests on babies', *Daily Mirror*, 22 Mar. 1960, p. 3; 'Strontium 90 in milk increased', *Times*, 4 Apr. 1960, p. 3; 'Radiation review premature', *Times*, 19 Oct. 1961, p. 12; 'Bomb caution by Medical Research Council', *Times*, 25 Oct. 1961, p. 6; 'Milk plan to counteract Soviet bomb fall-out', *Times*, 25 Oct. 1961, p. 10; Ronald Bedford, 'Fall-out', *Daily Mirror*, 25 Oct. 1961, p. 8; 'Lower iodine 131 level in milk', *Times*, 9 Nov. 1961, p. 14; 'Milk safe, even for young', *Times*, 24 Nov. 1961, p. 5. On the test see Victor Adamsky and Yuri Smirnov, 'Moscow's biggest bomb: the 50-megaton test of October 1961', *Cold War International History Project Bulletin*, 4 (1994), pp. 3, 19–21.

The fact that even ‘agony aunt’ Marjorie Proops addressed fallout in a column, criticizing actresses Leslie Caron and Vanessa Redgrave for warning against the dangers of strontium-90 contamination from nuclear tests, underscores its great topicality.¹⁵²

Through its investigation of the environmental and public health effects of nuclear testing, the ASA made a major contribution to the evolution of the British scientific debate over the hazards associated with atmospheric nuclear trials and played an important role in sharpening public awareness of these matters in the period leading up to the mass protests against nuclear weapons. The ‘Statement on strontium hazards’ marked the heyday of the ASA’s participation in the fallout debate, receiving wide national and international coverage.

Furthermore, members of the Labour opposition deployed it as scientific evidence for political purposes in order to challenge the conclusions reached by the MRC and to call the government’s thermonuclear testing programme into question. The ‘Statement on strontium hazards’ thus seemed, albeit unintentionally, to provide a counter-expert discourse on the effects of nuclear testing that appeared to reject some of the MRC’s conclusions. As a consequence, it represents a key text that revealed a rift between views on the dangers of fallout from nuclear testing held by many scientists, members of the public, and government. At the same time, the missive illustrates the ambivalent and difficult position of scientific experts in Britain’s post-war liberal democratic order. ASA members intended to rely on their expertise and serve as ‘objective’ mediators of nuclear knowledge between the state and the public. But these scientists compromised their roles as ‘independent’ experts when they liaised with the UKAEA over the content of the ‘Statement on strontium hazards’ prior to its release in an attempt not to embarrass and alienate the British government in light of several government employees’ senior roles in the ASA. And, what is more, the Committee on Radiation Hazards also worded its report carefully not to criticize the MRC but to suggest that additional information on strontium-90 – one specific aspect out of the many covered in the MRC’s 1956 report – had come to light. Despite exercising such caution, the ‘Statement on strontium hazards’ led to a rare moment of open confrontation between the ASA, especially members of its Committee on Radiation Hazards, and government offices, including investigations into the loyalties of some ASA members by MI5. The episode around this report thus exposes a fundamental dilemma that scientists in Britain and other Western liberal democracies confronted both during the debate over nuclear testing and fallout and the Cold War more widely between their roles and loyalties as ‘objective’ experts, socially responsible scientists, and loyal citizens. At the same time, it illustrates

¹⁵² Marjorie Proops, ‘Marjorie Proops says fall out, girls’, *Daily Mirror*, 17 Jan. 1962, pp. 10–11, at p. 10.

the ambivalent role and varied uses of expert knowledge in discussions over the environmental and health impacts of nuclear testing.

The ASA's role and influence, however, should not be overplayed. The fact that the statement was relatively brief and released in the name of Rotblat's group (and not the ASA per se), owing to some ASA council members' loyalty clashes between their roles as government employees and members of the association, as well as disagreement over the association's mission and the conclusions reached in the 'Statement on strontium hazards', underpins the limitations the group faced. Coupled with many members' adherence to an ambivalent concept of 'objectivity' and the ASA's grass-roots democratic decision-making process, these issues often prevented the association from reaching any agreements at all. Not only did its inability to agree on a coherent course of action paralyse the ASA, but this self-inflicted inaction increasingly called into question the association's purpose – with drastic consequences. While the ASA had already been in decline during the 1950s, the organization rapidly waned in the aftermath of the 'Statement on strontium hazards' and eventually folded in 1959. From 1957, some ASA members joined the ranks of the newly founded Pugwash Conferences on Science and World Affairs, a transnational network of international scientists that appeared to be a more effective forum for scientists across national boundaries and the Iron Curtain.¹⁵³

During the same period, the British government slowly changed its position on nuclear testing. Once the Eisenhower administration and the Macmillan government had signed a bilateral Agreement for Co-operation on Uses of Atomic Energy for Mutual Defence Purposes in July 1958, ending the provisos of the McMahon Act, Britain's nuclear programme became less dependent on atomic trials. Under the agreement, Washington was able to supply vital nuclear data, thus obviating the need for British atmospheric nuclear tests once the ongoing Operation Grapple series was completed.¹⁵⁴

With Grapple tests still under way, government officials initially continued to show concerns over a sudden implementation of a test stop and thus remained wary about the results of the first UNSCEAR report. In particular, two of its conclusions caused them headaches: first, that fallout posed 'new and largely unknown hazards to present and future populations', and, secondly, that a cutback in atmospheric nuclear contamination from atomic tests and other sources 'will act to the benefit of human health'. This prompted the FO to issue guidelines for its personnel to counter possible calls for a cessation of British nuclear tests.¹⁵⁵ But the government also became pro-active in its attempts to influence public opinion on nuclear testing by filming a staged

¹⁵³ Laucht, *Elemental Germans*, p. 171; Eugene Rabinowitch, 'Pugwash', *BAS*, 13 (1957), pp. 243–8, at pp. 243–4.

¹⁵⁴ Moore, *Nuclear illusion*, pp. 36–40, 150–5.

¹⁵⁵ UNSCEAR, 'Report of the UNSCEAR', pp. 1, 41, 98–123, 228; S. H. Evans, 'U.N. reports on radiation hazards', 8 July 1958, TNA, PREM 11/2553; Sandys to De Zulueta, 28 May 1958, TNA, PREM 11/2553; Higuchi, 'Radioactive fallout', pp. 282–324.

press conference ahead of the report's publication date. Featuring the British UNSCEAR members Edward E. Pochin, William G. Marley, and A. C. Stevenson, it was embargoed until the official release date of the UNSCEAR report.¹⁵⁶ Government offices used great caution in planning the event. The UKAEA, for example, only 'agree[d] to Dr. Marley taking part in the proposed Press Conference on the understanding that (a) he is not a principal spokesman, and (b) he appears in his capacity as Technical Expert and alternate representative of the U.K. Government on the U.N. Committee and not on behalf of the Authority'.¹⁵⁷ Harold Macmillan shared such concerns over potential conflicts of interest and proposed 'that invitations to the [press] Conference should for the same reason, not be issued by the Atomic Energy Authority but rather by the Chancellor of the Duchy'.¹⁵⁸

To assess the scientific validity of the UNSCEAR report, the Macmillan government relied on Himsworth's MRC committee.¹⁵⁹ Alongside Himsworth and Cockcroft, both Alexander Haddow and Lionel Sharples Penrose continued to serve on the board. In principle, the Committee on the Hazards of Nuclear Radiation agreed with UNSCEAR's findings. 'In our view, it is not possible at this present time to decide whether there is or is not a threshold dose concerned in the induction of leukaemia and cancer', Himsworth and his co-authors warily noted on the contested existence of a threshold dose, adding: 'and the only scientific attitude to the problem at present is one of suspended judgement'.¹⁶⁰ Therefore, the MRC essentially adopted the ASA's cautious position on a threshold dose.¹⁶¹ Publication of the MRC statement was scheduled

¹⁵⁶ Charles Hill, 'From the chancellor of the Duchy of Lancaster, lord president of the council', 11 June 1958; Plowden to Bishop, 18 June 1958; Office of the Chancellor of the Duchy of Lancaster, 'Note of a meeting at the Old Treasury on Thursday 24th July to discuss publicity arrangements on publication of the United Nations report on radiation hazards', 28 July 1958; Quintin McGarel Hogg [Viscount Hailsham], memorandum for prime minister, re: 'U.N. Scientific Committee on the Effects of Atomic Radiation', 6 Aug. 1958; Office of the Chancellor of the Duchy of Lancaster, 'Confidential until 5 p.m. (British summer time) 10th August, 1958: report of the United Nations Scientific Committee on the Effects of Atomic Radiation. Note of a press conference at the Board of Trade 4.0 p.m. 6th August', 7 Aug. 1958, all in TNA, PREM 11/2553.

¹⁵⁷ Michaels to Bishop, 8 July 1958, TNA, PREM 11/2553.

¹⁵⁸ N. F. C. to Simpson, 4 July 1958, TNA, PREM 11/2553.

¹⁵⁹ Edmund Colquhoun Pery to Quintin McGarel Hogg, Aug. 1958, in MRC, Cmnd 508, *Statement on the report of the United Nations Scientific Committee on the Effects of Atomic Radiation: presented to parliament by the lord president of the council by command of Her Majesty, August 1958* (London, 1958), p. 3, TNA, PREM 11/2553.

¹⁶⁰ Harold P. Himsworth et al., 'The report of the Scientific Committee on the Effects of Atomic Radiation to the Thirteenth General Assembly of the United Nations: a report to the Medical Research Council by their Committee on the Hazards to Man of Nuclear and Allied Radiations', in MRC, Cmnd 508, pp. 4, 6, 13.

¹⁶¹ This also found expression in the recognition of new international standards in radiation dose levels and measuring techniques in Cmnd 1225, MRC, *The hazards to man of nuclear and allied radiations: a second report to the Medical Research Council, presented to parliament by the lord president of the council and minister for science by command of Her Majesty, December 1960* (London, 1960).

to take place about ten days after the release of the UNSCEAR report.¹⁶² In an attempt to maximize publicity, the forthcoming MRC report on UNSCEAR's findings was to be announced during the staged press conference.¹⁶³ This careful planning perhaps marked an attempt by British government offices to avoid repetition of the controversy over the 1956 MRC report and the subsequent ASA statement.

Once Operation Grapple had been completed by September 1958, '[t]he ambivalence with which the Macmillan government had previously approached the test-ban goal was converted into a very real enthusiasm', Kendrick Oliver observes.¹⁶⁴ Eventually, Britain – alongside the Soviet Union and the United States – ratified a Partial Nuclear Test Ban Treaty (PTBT) in Moscow on 5 August 1963, coming into effect on 10 October of the same year.¹⁶⁵ The PTBT had a significant impact on the test ban debate. As Joseph Masco argues, 'it changed the terms of the public discourse about the bomb, as the state no longer had to rationalize the constant production of mushroom clouds and the related health concerns over radioactive fallout'.¹⁶⁶ In the wake of the PTBT, protests against nuclear weapons in Britain and elsewhere declined significantly, and even the anti-nuclear weapons mass movement struggled.¹⁶⁷ In any case, by that time the ASA had long vanished, and its crucial yet ambiguous role as an interface between nuclear knowledge, the public, and the state in the immediate period leading up to the anti-nuclear weapons mass protests from 1958 onwards had started to fade into oblivion.

¹⁶² Simpson to Shedden, 13 Aug. 1958, TNA, PREM 11/2553.

¹⁶³ 'Draft press release on the report of the U.N. Scientific Committee on the Effects of Atomic Radiation', n.d., attached to letter, Simpson to Shedden, 5 Aug. 1958, TNA, PREM 11/2553.

¹⁶⁴ Oliver, *Kennedy, Macmillan, and the nuclear test-ban debate*, p. 8.

¹⁶⁵ 'Treaty banning nuclear weapon tests in the atmosphere, in outer space, and under water, August 5, 1963', repr. in Robert C. Williams and Philip L. Cantelon, eds., *The American atom: a documentary history of nuclear policies from the discovery of fission to the present 1939-1984* (Philadelphia, PA, 1984), pp. 202-5, at p. 202.

¹⁶⁶ Joseph Masco, "'Survival is your business": engineering ruins and affect in nuclear America', *Cultural Anthropology*, 23 (2008), pp. 361-98, at p. 378.

¹⁶⁷ Lawrence S. Wittner, 'The nuclear threat ignored: how and why the campaign against the bomb disintegrated in the late 1960s', in Carole Fink, Philipp Gassert, and Detlef Junker, eds., *1968: the world transformed* (Cambridge and Washington, DC, 1998), pp. 439-58.