

In the case of arms control, as in several other aspects of policy, Dr Simpson's detailed account of British policy makes clear how often things were not what they seemed, how often apparent virtue masked more selfish motives, and how good causes produced unanticipated effects. This was particularly clear in the 1950s with initiatives for "Atoms for Peace", for a test ban, and for a cut-off of fissile material production. As keen as the Eisenhower Administration was on impeding the Soviet erosion of American nuclear superiority and on discouraging the French and Chinese nuclear programmes, the British were still on the wrong side of the line so far as actual achievement of their own stockpile was concerned, particularly of thermonuclear weapons. They were able to use their obstructive potential to win help in accelerating their programme through the 1958 amendments to the MacMahon Act. As a precaution Britain had also accelerated its plutonium output, however, and once American assistance led to more economical warhead designs, was able to barter plutonium for further assistance. All quite useful, perhaps, but not what was originally intended and rather remote from the issues with which political debate in either country was ostensibly concerned.

A better known paradox of the British nuclear relationship with the United States is illuminated by Dr Simpson's characterization of the roles played by Britain's two leading political parties. As Ernest Bevin's remark quoted earlier reminds us, the Labour Party, presumably because of a latent suspicion of the United States, was not only the founder of the independent British nuclear programme, but the more insistent that it should be independent. The first British tests were conducted in Australia rather than, as might have been possible and cheaper, in the United States, chiefly because Clement Attlee was unwilling to become dependent on the Americans. Churchill, by contrast, was much more inclined to see the nuclear programme as a tool in strengthening Anglo-American relations, even at the price of some loss of independence. It was Macmillan who based British nuclear power on an American missile but Labour Governments under Harold Wilson and James Callaghan which

secretly completed the new re-entry vehicle *Chevaline* and reacted to a rising tide of American anti-proliferationism, especially under President Carter, by establishing a national source of tritium and reopening stages of the British enrichment plant. Once President Reagan changed the rhetoric, it was the subsequent Thatcher Government that slowed down this process and purchased yet another American missile.

In the last and inevitably most speculative part of his book, Dr Simpson considers the future of this trans-Atlantic nuclear relationship and of the British force within it. Reluctantly he comes to the conclusion that Britain could not readily become a non-nuclear power even if it wanted to do so; it is too impregnated with knowledge and capability. This observation constitutes yet another recognition of how elusive the distinction between nuclear and non-nuclear powers becomes as understanding of nuclear engineering proliferates. Nuclear weapons play their part chiefly as latent factors in political relations. Hence the importance attached to the status of Israel and India as virtual nuclear powers or to Argentina and Pakistan as nearly-nuclear powers. Somewhat the same relativism is appropriate in contemplating the pervading question raised by Dr Simpson's book: just how independent is the British deterrent? The brief reply is that there is no simple answer to such a question; most of the time derivative weapons, like potential weapons and suspected weapons, can all play some part in the political balances.

Nevertheless the state of Anglo-American nuclear relations is a major influence on the tone of the alliance, and one reason Dr Simpson's book is timely is that several current trends could radically alter that relationship in the next few years. In Britain, the chief source of instability lies in the Labour Party's move outside the bipartisan consensus that has prevailed since the 1940s. In the United States, if the mood represented by Dr Henry Kissinger's recent demand that the Europeans should show greater self-reliance in defence gains much ground, it must inevitably become entangled with Mr Robert McNamara's parallel insistence that the United States offer less by way of nuclear guarantees to Europe. The relatively relaxed British attitude to the question of dependency or independence has flourished under the shade of a sturdy American nuclear umbrella. It is too early to say what the outcome would be if the web of mutual Anglo-American understanding in nuclear matters began to unravel. The story told by Dr Simpson does suggest one firm prediction, however, and that is that the result is highly unlikely to be exactly what anyone intended. □

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Binary weapons: the monster is loose

John Erickson

No Fire No Thunder: The Threat of Chemical and Biological Weapons.

By Seán Murphy, Alastair Hay and Steven Rose.

Pluto Press: 1984. Pp.145. Pbk £3.95.

MANY years ago we bravely faced the "bomber gap". Latterly we have been strenuously persuaded of the "missile gap" in its various configurations, not to mention the attendant "window of vulnerability" — the metaphors tend to become a little mixed — but we are back again with what is currently advertised as the "gas gap". The deterrent, or one component of it, is again threatened, or so Richard L. Wagner, assistant to the US Secretary of Defence, asserts. "The United States currently lacks a deterrent to a Soviet chemical weapons attack in Europe", since there is no counterpart to match Soviet capability to lay down a persistent gas screen beyond the 10 kilometre artillery range.

Soviet forces, equipped with binary weapons and "14 or 15 chemical weapons capable of being delivered at long ranges", can deliver persistent agents deep within NATO's rear, well beyond artillery range, engulfing logistics, supply centres, airfields, and command and control links. At such ranges NATO forces must fight "buttoned up", encumbered with protective gear, while Soviet rear areas would be virtually immune: air delivery of chemical agents by NATO at present involves pilots flying what amounts to suicide missions, coming in low and on a predictable course, only to deliver antiquated munitions as a spray which disperses all too quickly. Hence the "gas gap", and weapons such as BIGEYE (a spray bomb for F-111 aircraft) as well as plans to develop some 15 types of munitions in the binary role.

The subject of chemical and biological warfare (CBW), while having its own arcane vocabulary, also exudes singular repulsiveness. "Binary weapons" sound almost clinically clean, shut away from this house of horrors, but the monster is loose, striking most recently in the Iran-Iraq war where mustard and nerve gases have been used. This alone would give *No Fire No Thunder* not only great timeliness but also added value as a guide to this particular type of warfare, BIGEYE included as well as those reports from South-east Asia and Afghanistan. In the latter context, operations in Afghanistan, the reader can usefully turn to an article by Dr E. M. Spiers, "Gas and the North-West Frontier", published in *The Journal of Strategic Studies* (December 1983), a review of British attitudes to gas and "frontier difficulties".

Whatever the wrangling over the use of

Journal reviews 1984

The next review supplement to appear in *Nature* will be the New Journals Review, on 27 September. Criteria for journals to be considered for review are:

(i) the first number appeared, or the journal was re-titled, between June 1982 and May 1983 (these time limits allow for the publication of several issues of a journal, on which a reasonable judgement may be based);

(ii) the journal appears at least three times a year;

(iii) the main language used is English.

During May publishers will be requested to submit four issues of appropriate publications for review.

particular agents in Afghanistan and South-east Asia, chemical agents as such together with toxic trichothecenes — a form of “biochemical warfare” —, there can be no dispute about the onset of “chemical warfare” in the Iran–Iraq war. Both TABUN(GA), ethyl-*NN*-dimethylphosphoramidate cyanidate and mustard gas (dichloroethyl sulphide) have been used on the battlefield, all in a pattern strongly reminiscent of the use of chemical weapons by Italy in Ethiopia in 1935–1936, using this type of weapon against forces poorly equipped to neutralize their effects. That background, and indeed one much wider, bringing the story into the 1970s, is amply delineated by Chapter 2 of *No Fire No Thunder*: this account is especially useful for its careful classification of the various agents and their possible use. In short, the book is an excellent updating of the major six-volume work from the Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare*, first published in 1971.

To say that the whole subject is an emotive one is to make a massive understatement. The folk memories of the First World War, and of the release of 168 tons of chlorine by the Germans at Ypres in April 1915, have not faded. And during the Vietnam War, American public opinion was outraged at the use of emetic gas which caused enemy soldiers to vomit on the battlefield, part of public revulsion at weapons which kill “slowly”. The authors of *No Fire No Thunder* made excellent use of such historical examples to emphasize the “cynicism” of the wording of CW agreements — the Germans did not use *projectiles* to disseminate liquid chlorine — and the implications of a new arms race almost hidden under such euphemisms as “binary weapons”, not to mention a propaganda war of words designed to justify chemical weapons rearmament.

Though cynicism may be admitted in the drafting of agreements, deftly designed to provide loopholes, Dr Nicholas Sims has also underlined the significance of these niceties in his paper “Mycotoxins and Arms Control” (ADIU Report, December 1981) on the applicability of the Geneva Protocol of 1925 and the 1972 Convention on Biological and Toxin Weapons. This is not mere legerdemain but an issue of the greatest importance, one somewhat glossed over by the authors in their discussion of “yellow rain” in Chapter 4: it is perhaps a most unfortunate turn of phrase to insist on “healthy scepticism” about “yellow rain” when the whole context is decidedly unhealthy.

Meanwhile, the entire question of CW arms control has been raised anew with President Reagan’s latest proposals for banning the production, possession *and use* of chemical weapons, coupled as it is with a call for American investment in its own “limited retaliatory capability” in chemical weapons. With respect to that key issue, *verification*, Soviet officials have

already indicated willingness to open “declared” sites to inspection but refuse any comprehensive “right to look”.

Earlier talks in 1976–1979 between the superpowers founded on verification, a factor which may well prevent any global agreement in the future. Not all is lost, however, if we pursue Professor G.K. Vachon’s suggestion, made in *Survival*, that regional arrangements might be made for curbing CW, much on the lines of the Treaty of Tlatelolco banning possession and use of nuclear weapons in Latin America. In a sense, the industrialized nations have tended to regard the 1925 Protocol as a “no first use” undertaking, even though it is tacit; but the authors of *No Fire No Thunder*, in a chilling chapter, point out the utility of CBW in military situations. It is almost as if two escalatory arms races are fusing, one technologically highly advanced, the other in basic CW capabilities.

Though CB weapons are sometimes labelled as agents of “mass destruction”, this may be something of a misnomer, a point made with great precision in Chapter 5 of the book, on CBW and military

scenarios. Chemical weapons were used “strategically” in both the Sino-Japanese war and in Vietnam: Japanese interest in bacteriological warfare was quite purposeful, if one looks at a lecture delivered by Dr Enryo Hojo, *Über den Bakterienkrieg*, delivered at the Military Medical Academy in Berlin in 1941 (see US National Archives Microcopy T-82 Roll 90/246588-629) and subsequent evidence from the experiments in the Manchurian prison camps. *No Fire No Thunder* examines in some detail the operational scenarios involving quick-acting anti-personnel chemical weapons, the “mix” of conventional and chemical weapons, persistent agents and nerve gases — both rapidly clearing and long lasting. It is certainly an apt description to label these “search and denial weapons”: they are area weapons, they are undeniably “search weapons” (engaging both hard targets and dispersed forces), they afford considerable degrees of flexibility for a commander and they can inflict high casualty rates, particularly when used in surprise attack.

There is, however, the factor of unpredictability, whatever the precision of the planning. A recent computer study has

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REASONS

LUP/THPO31601-03/16/84-AHVAZ, IRAN: A United Nations fact-finding delegation member kneels 3/14 to make photos of an Iraqi chemical bomb that failed to explode during an air raid in the southern Iran–Iraq border. The delegation arrived 3/13 and went to the contaminated fronts 3/14. UPI cs/irna

demonstrated that in any European conflict, with 1,000 tons of nerve gas used each day by both sides, civilian casualties would be counted in millions and the ratio of civilian to military casualties would be 20:1. While biological weapons are generally discounted for use on the battlefield — nerve gases act much more quickly — the authors of *No Fire No Thunder* do not ignore the "social repercussions" of CBW warfare, including the overwhelming of medical services and the breakdown of public order, not to mention the appalling consequences of the use of biological weapons in sabotage actions. I do not regard this as scare talk: consider the death, havoc and tribulations brought about with the deliberate random poisoning of a patent medicine in the United States, a small instance of what might come to pass.

If this were not enough, Chapter 8 outlines further developments in CB weapons, with discussion of the military exploitation of genetic engineering, bringing with it the possibility of "rampant pathogens and large-scale production of both known and new toxins". According to the authors, the search is on for "undercover tactical agents" specifically designed to debilitate the opposition. Nor does the work on chemical agents stop, with US binary munitions including a new agent crossed between Sarin and VX, "modified soman" (EA5774), and growing interest in civilian control agents.

The authors conclude, not implausibly, that both the United States and Soviet Union envisage operations in Europe which will be chemical as well as nuclear, though rational argument would suggest that no appreciable strategic or tactical gain can accrue from increasing CW arsenals. Yet the burden of Chapter 5 — on military scenarios — is that there is appreciable operational advantage to be gained from CW and serious potential in BW for sabotage and disruption. The last chapter takes the form of an impassioned appeal for chemical disarmament, for a "CW-free Europe" propounded by a pan-European movement: with Britain "a nuclear and chemically disarmed country", the authors go on to admit a need to consider the defence of the *population* against any chemical attack. I should have thought that might be considered even now, though politically it is ruled out if only because it raises the whole question of population protection, as opposed to shelter for select élites.

Meanwhile this timely, coherent and highly informative book should receive very wide attention: it is not comfortable reading but it is highly urgent reading, even for those who might think themselves informed on the subject. □

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Radiating sense

K.V. Ettinger and
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Nuclear Radiation: Risks and Benefits.

By Edward Pochin.

Clarendon: 1983. Pp.197. £17.50, \$32.50.

... The B vocabulary consisted of words which had been deliberately constructed for political purposes, that is to say, which not only had in every case a political implication, but were intended to impose a desirable mental attitude. ... (George Orwell, *Nineteen Eighty-Four*).

THE complete edition of *Newspeak B Vocabulary* is not available through the book trade and we are not certain whether the expression "radiation protection" is a part of it. But whatever the gestation of this term, it served perfectly well to calm the minds of Project Manhattan workers, who, as we know nowadays, were on many occasions exposed to doses of radiation which would be unacceptable today.

Edward Pochin's *Nuclear Radiation: Risks and Benefits* serves as a reminder that a large part of radiation protection is just monitoring doses of radiation received by individual radiation workers, and that "protection" is afforded by the legislative process which itself is in part a function of public sensitivity on the matter. So that the reader may arrive at an informed comparison between risks and benefits of ionizing radiations (not only nuclear, as the title implies), the author gives a detailed exposition of the techniques of radiation measurement as well as an account of the amounts of radiation which we receive from natural and man-made sources. And so that the deleterious effects of radiation are understood, there is a good review of the relevant parts of radiobiology. The counterbalancing of risks and benefits is not discussed in quantifiable terms, however, simply because such analysis is not available as yet; after all "the quality of life" is not easily reduced to numbers.

Instead, in his final chapter Pochin provides a careful comparison between risks (expressed in number of deaths per

Nuclear power

Oxford University Press have issued a major reference work in three volumes, *Nuclear Power Technology: The State of the Industry*, which (according to the publisher) "will provide the scientist and layman alike with a comprehensive and up-to-date reference on all aspects of nuclear power".

Editor of the work is Walter Marshall, Chairman of the Central Electricity Generating Board, and the contributors are all specialists drawn from the industry itself. Titles of the individual volumes are: *Reactor Technology*, *Fuel Cycle* and *Nuclear Radiation*. Price is £35, \$65 per volume.

100,000 per year) for various occupations and for workers exposed to cancer-causing agents, and also gives the general number of fatalities due to accidents. This comparison indicates that it is a valuable exercise to analyse avoidable risks in many industries and, as a corollary, to get rid of those technologies and agents which needlessly contribute to the misery, high death rate and sickness of people exposed to them. Again, however, it is extraordinarily difficult to weigh the risks against the benefits of these factors in precise terms since we are often dealing with a situation in which industry benefits financially from the technologies it uses — the risks are borne by the employees personally and by the state fiscally, but how do we compare individual risks with community benefits or vice versa?

Be this as it may, and despite the fact that Pochin's tables indicate that radiation hazards are not the top priority if resources are limited, for many the conclusion to be drawn from the book is that positive action is needed: a determined effort to reduce and even eliminate the use of ionizing radiation in all circumstances in which it can be replaced by other agents. Recently developed analytical techniques, both chemical and physical, offer the possibility of replacing radioactive tracers by stable compounds. Many of the gauges used in industry for measurement of thickness, moisture content and so on can be replaced by instruments based on other techniques, and it is worthwhile examining alternatives to industrial radiography. A similar approach has already been taken in the field of medical applications of radiation and radioisotopes. The use of nuclear magnetic resonance for tissue imaging is making fast progress and the population-averaged radiation doses from medical radiology, which according to Pochin exceed those from radiotherapy, should be gradually reduced to the unavoidable minimum. Obviously, the nuclear industry, and particularly the nuclear power industry, are the cynosure of the public eye in this respect, and the subjects of a broader debate.

The book is well and smoothly written, with a sense of wry humour, though it sadly lacks extra drawings, photographs and graphs which could have made the going so much easier. Those illustrations which are included seem to be the end result of some random selection. Nonetheless the book can be certainly recommended to those who are concerned with the effects of ionizing radiation, whether professionals or laymen. They will acquire an excellent source of information, impartially presented. But it will not serve everybody equally well. After all, it was Winston Smith who said: "Ignorance is strength". □

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