

THE NEUTRON BOMB



Professor Eric Burhop

Sanity

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Campaign for Nuclear Disarmament

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Preface to 2nd edition

This little pamphlet written in July 1977 on the evening of the very day that President Carter announced he was in favour of developing a neutron bomb has had a remarkable and unexpected reception. It has been translated into the Arabic, Bulgarian, Danish, French, German, Polish, Portuguese, Russian and Spanish languages and published in twelve countries.

Since the first edition is out of print I thought, in preparing a second edition it should be updated. The main change is a more correct and realistic description of the way the neutron bomb works than I was able to conjecture immediately following the initial announcement. The description of the most probable mechanism of the bomb shows that its actual threat to civilian populations exposed to it will be far greater than I thought when I wrote the original pamphlet since the actual intensity of the neutron radiation even from a very small bomb will be many times larger than I originally estimated.

I am greatly indebted to several colleagues who have helped me in arriving at a clearer understanding of the probable mode of action of the neutron bomb, particularly to Professor KF Alexander, Head of the Nuclear Physics Institute of the German Democratic Republic, who presented a very illuminating paper "Zur Physik der Neutronenbombe" at the meeting of the Standing Committee on Disarmament of the World Federation of Scientific Workers held in Berlin in September 1977. I should like especially to express my thanks and appreciation to the Amalgamated Society of Locomotive Engineers and Firemen (ASLEF) and especially to its General Secretary, Ray Buckton, who generously arranged the production of the first edition of this pamphlet. To Ray also for encouraging me to prepare this second, revised edition.

The world-wide revulsion and response against the bomb has also been a source of great encouragement. It has certainly served to revitalise the whole campaign against the arms race, for the abolition of nuclear weapons and for general disarmament, which continue to form the long term objectives of the World Federation of Scientific Workers in this field.

Introduction

President Carter has announced he is in favour of the development of a neutron bomb, but has not yet decided whether he is in favour of its deployment. The neutron bomb kills people but spares property. It does not kill them instantly but causes them to die a slow, lingering, often terribly painful death after a few days, weeks, months or even years, depending on how close they were to the place where the bomb was dropped. If they were expectant mothers at the time of the exposure, there is a high probability of miscarriage. If they live long enough to conceive after the exposure, the chance that their children will be born with congenital defects will be greatly increased. The rest of their lives will be like those of the A-bomb victims in Japan, some of whom eke out a miserable existence, even till this day, with injuries so terrible that even their closest kin shrink with horror and revulsion when they see them.

President Carter has made a great show of his moral and religious convictions and his concern for human rights. Perhaps he should be reminded of the biblical text "By their works, ye shall know them". By his decision on the neutron bomb, President Carter may well be judged by posterity, either as a sincere humanitarian, or an unctuous hypocrite.

In this short pamphlet, I have tried to set out in simple terms what a neutron bomb is, the kind of damage it can do, its role as a tactical weapon either for defensive or aggressive purposes and its importance in relation to European security, the continuing arms race and detente.

What is a neutron bomb?

A neutron bomb is a small hydrogen bomb in which the components are arranged so as to augment greatly the neutron radiation. In an ordinary atomic bomb large quantities of neutrons are released but their effects are overshadowed by other effects—the intense blast, which completely demolishes buildings over a very wide area, killing or burying alive those inside; the searing heat flash which incinerates those caught in the streets over a similar area; the persistent radioactive fall-out projected by the force of the explosion over an even wider area. Compared with these the effects of the neutron radiations are lethal only up to distances of about 1km (for a Hiroshima type bomb). If the victims within this distance had survived the effects of blast and heat flash they would surely have perished later from the neutrons. But one can only die once!

Since the dropping of the atomic bomb on Hiroshima a great deal of effort has been directed toward developing a smaller atomic bomb in an attempt to bridge the gap between the largest TNT block-busters (using some tens of tons of TNT) and the smallest atomic bombs. It is believed that atomic bombs with yields as low as 400 tons of TNT equivalent have been produced, compared with the 20,000 tons of TNT equivalent of the Hiroshima bomb. This "miniaturization" of atomic bombs is achieved using a triggering method known as "implosion". In this method a spherically shaped charge of conventional explosive is placed around some plutonium (or uranium 235). When the conventional explosive is detonated it forces the pieces of plutonium together and strongly compresses them, thus greatly increasing the density of the plutonium. Under such conditions its "critical size", that is the minimum amount of plutonium (or uranium 235) that has to be brought together before it produces an atomic explosion, is greatly reduced. Instead of a critical size of several kilograms needed for the Hiroshima, some hundreds or even tens of grams of this super-dense material will suffice. The explosive yield is correspondingly reduced but the relative amounts of energy

going into blast, heat, and radiations such as gamma rays and neutrons is not much affected. This is the principle of the small atomic bombs (the "mini-nukes").

Most people think of hydrogen bombs as very large objects which produce enormous explosions equivalent to millions of tons of TNT equivalent and enormous amounts of radioactive fall-out. This is true indeed for the hydrogen bombs about which most has been written. But this is not necessarily the only type of hydrogen bomb that can be envisaged. The essential feature of the hydrogen bomb is that a mixture of two rare forms of hydrogen, known as deuterium (^2H) and tritium (^3H) are heated together to a temperature of many millions of degrees. At such temperatures nuclear (fusion) reactions can take place just like those that take place in the sun. These produce enormous quantities of neutrons. In the neutron bomb it appears that only quite small amounts of deuterium and tritium (only a few grams) are needed. If some mixture of these forms of hydrogen is placed inside the uranium or plutonium in one of the small atomic bombs described above and the bomb then detonated, the necessary high temperature needed to ignite the deuterium and tritium is produced by the atomic bomb explosion. At the same time the deuterium and tritium itself become highly compressed, thus aiding the ignition. With such an arrangement the effects of blast and heat are not much greater than in the small atomic bomb itself. By exploding it at a height of about 500m above the ground, the blast wave when it reaches the ground is not strong enough to destroy strongly constructed buildings. On the other hand, the neutrons are extremely lethal. Eighty or even ninety per cent of the whole of the energy from the hydrogen bomb explosion comes off in the form of neutrons. This is why it can truly be said that the neutron bomb is designed to kill people while keeping property intact.

There will be some radioactive fall-out from the small atomic bomb needed to ignite the hydrogen bomb. But since its explosive strength is comparatively weak the amount of fall-out will be correspondingly decreased. The intense neutron radiations coming at the instant of explosion, from the hydrogen fusion part of the bomb will make radioactive the ground and nearby buildings, below where the bomb is exploded, so that it could be quite dangerous to go into the affected area except in a tank or similar vehicle that can provide protection from the radioactive radiations. But most of these induced radioactive materials produced by the neutrons in this way are

short-lived.* After some weeks they will almost all have decayed into harmless end products and it will be safe for unprotected people to enter the area again. So that having disposed of the indigenous population of a city in this "final solution" the enemy will be able quite safely to walk in and take it over as a going concern.

* An exception is the radioactive form of carbon, (^{14}C), which is produced by the absorption of neutrons in the atmosphere. Its radioactivity will last for thousands of years but will be too weak to be dangerous.

What are the effects of a neutron bomb?

To explain the effects of a neutron bomb on the unfortunate victims what more authoritative source could one use than the official report "The Effects of Atomic Weapons" issued in 1950 by the United States Atomic Energy Commission and Department of Defence. This gives figures for the distance at which neutron radiations from an ordinary atomic bomb will produce lethal or semilethal radiation effects. The radiation effects themselves are very similar whether they are produced by neutrons, by gamma rays or by radioactive fall-out. The distance at which a lethal dose is produced by neutrons from an atomic bomb is given as approximately 750 metres. From a neutron bomb, this distance would be expected to be greater, because the neutrons produced in the fusion of deuterium and tritium are faster, but it would not extend more than 1 to 1.5 kilometres.

Here are some of the descriptions of the way these victims die in the words of the official United States Atomic Energy Commission publication cited above "... individuals were found to exhibit varying degrees of shock, possibly within a few hours. This was accompanied, or followed shortly, by nausea and vomiting, and then by diarrhoea during the first day or two after exposure; subsequently there was a development of fever. The diarrhoea was frequent and severe in character, being watery at first and tending to become bloody later ... Although there was no pain in the first few days, patients experienced a feeling of discomfort or uneasiness (malaise), accompanied by marked depression and bodily fatigue. The early stages of the severe radiation sickness may or may not be followed by a so-called latent period of 2 or 3 days during which the patient is free from symptoms although profound changes are taking place in the body. This period, if it occurs, is succeeded by reappearance of the same symptoms and active illness, accompanied by delirium or coma, in many cases terminating in death, usually within two weeks.

"Among other symptoms which have been observed are secondary infection and a tendency to spontaneous internal

bleeding towards the end of the first week. At the same time, swelling and inflammation of the throat is not uncommon. Loss of hair, mainly from the head, may occur by the end of the second week . . . a decrease in size and degenerative changes in the testes and ovaries; ulceration of the tonsils and of the mucous membrane of the large intestine . . . characteristic increase in the body temperature (fever) . . . continuing until the day of death."

Other symptoms specified include severe inflammation of mouth and throat, pallor, nosebleeds, rapid emaciation, a severe decrease in the number of white blood cells due to "extreme atrophy of the bone marrow" which in some cases was replaced by a "gelatinous deposit." The destruction of the white blood cells means that the body cannot fight infection so that "normally harmless bacteria, ordinarily found within the digestive tract and on the skin may actually gain access to the blood stream and cause blood poisoning and fatal infection". The fortunate ones may die within two to four weeks. Those one or two kilometres away at the time of the explosion may linger on for years with distressing conditions of this kind.

This is the nature of the weapon that President Carter has taken the initiative in giving the go-ahead to develop.

Is the neutron bomb a new weapon unlikely to be developed by other countries?

No. Every nuclear power with experience of making other types of nuclear weapons will be familiar with the principles used in the neutron bomb. Even in 1944 when I was working on the Manhattan project, the US atomic bomb project, I heard discussion of the possibility of varying the configuration and rate of explosion of the bomb in order to maximise one or other of the various kinds of effects, including neutron radiation, from the bomb. Of course this was relevant to the atomic bomb. The hydrogen bomb had not been developed in those days.

If the NATO countries develop and deploy this weapon, there is no doubt that the Warsaw Pact countries will easily be able to develop it if they wish to do so, and the NATO powers face the prospect of having it deployed against themselves also. It is by no means certain that they will wish to do so however. Why should they? Whether one approves of Communist doctrine or not, nobody would surely accuse it of placing protection of property before that of people. It seems most likely that if the NATO powers choose to use the neutron bomb, thus breaching the nuclear threshold, the Warsaw Pact countries will feel entitled to reply with ordinary atomic weapons of which they no doubt already have large stockpiles. But having initiated the development of this repugnant weapon, the NATO powers will have to bear the obloquy of introducing it first into the arsenals of nations, thus escalating the arms race to a new level of horror. If they use it there is likely to be immediate retaliation either in kind or through the use of other kinds of atomic weapons ("mini-nukes"), leading to the escalation of what might have been a limited incident into full scale nuclear war.

Is the neutron bomb a tactical defensive weapon for use in the field, or is its use of most significance for an aggressor?

The neutron bomb is of limited significance for tactical use against armies in the field. If it is known that neutron bombs are being deployed, new military tactics will obviously be developed in which military forces are dispersed and large concentrations of infantry avoided. Tanks will be modified in construction in order to shield the occupants against the effects of neutron radiation. This should not prove to be too difficult a task. Already the armour plated construction of the tank will absorb some of the neutrons. By increasing the thickness of the iron surrounding the cabin in which the tank crews are situated, lining it with layers of plastic material three inches thick doped with the element boron or covered with thin cadmium sheets, it should be possible to devise a tank construction that can protect against the neutron radiation. In any case even soldiers who have received a lethal dose of neutron radiation will be able to fight on for some hours since, unless the dose is many times the minimum lethal dose, the effects are not immediate. This will give time for their replacement by reserves that have not been affected.

For the same reason also it would clearly be a suicidal weapon for a country defending its cities and industries against the attack of an aggressor since its use would kill far more of the defenders than of the attackers.

It is however the weapon par excellence of the aggressor determined to take over intact cities and industries of another country. We can image how Hitler and Goebbels would have smacked their lips if they had had such a weapon at their disposal during the Second World War. It would have provided the ideal means for the "final solution" not only of the Jewish problem but also of the Russian, Polish, Czech and who knows, of the French and British problems. What a splendid vista it would have opened up for the whole wealth of Europe to be available intact to be exploited by the Nazis for their "New Order in Europe", unencumbered by the presence of the natives!

Would the deployment of the neutron bomb increase the risk of full scale nuclear war?

Yes, undoubtedly, because, as mentioned above its use would have breached the nuclear threshold. There is a qualitative difference between nuclear and other weapons. For example, the most powerful conventional weapon, the big block-busters of the Second World War used about ten tons of TNT. The vast bulk would make a larger conventional weapon unwieldy and impracticable. Even the smallest nuclear bomb carrying a charge of uranium 235 or plutonium of less than 1 pound has an explosive power equivalent to 400 tons of TNT. In going from the smallest conventional weapon to the largest nuclear weapon the only natural break in explosive power occurs when one passes from one kind to the other. But of course there are also the qualitative differences between the two kinds of weapons—the nuclear bomb, at the moment of explosion, is like a miniature sun. It will start many fires over a wide area, leading to the possibility of a fire storm when the fires merge and become uncontrollable. It produces instant radiation—neutrons and gamma rays—with the terrible effects already described. It leaves behind radioactive fall-out, continuing to emit the deadly radiations for long after the bomb explosion.

For all these reasons it is almost universally accepted that all nuclear weapons are in a very different category from conventional weapons. To cross the gap between them, to breach the nuclear threshold, will certainly lead to incalculable consequences, converting what could have proved to be a minor incident, readily settled by negotiation into full scale nuclear war with all its appalling consequences for our own and future generations. There can be no question whatever that a neutron bomb is a nuclear weapon. There is no other natural break between the smallest so-called "tactical" neutron bomb and the largest 100 megaton "strategic" nuclear monster. Any distinction the military planners of one side may draw is pointless unless their potential opponents on the other side agree. There seems no possibility of agreement on such a matter.

nuclear weapons provide the most likely way in which a full scale nuclear war could start. Great precautions are taken against the use by accident of the so-called strategic "nuclear deterrent". On the NATO side only the President of the United States can finally authorise its use. All kinds of safeguards, including such things as the "hot line" have been devised to prevent their use by accident. In theory at least the large nuclear weapons forming the "deterrent" have been built, not for use, but to deter nuclear war.

By contrast the so-called "tactical" weapons of which the neutron bomb is the latest, are built to be deployed in large numbers on the battlefield under the control of the commander on the spot, to be used in certain tactical situations. It is as certain as night follows day that their initial use would be followed by the use of larger nuclear weapons by the other side, leading to an escalation which there is nothing to stop short of the use of the largest available strategic nuclear weapons. Mankind and its whole future may be placed in jeopardy by the quick, trigger-happy decision of some field officer acting in emergency under conditions of great stress when cool judgement is impossible. This is perhaps the main threat posed by the neutron bomb and is indeed the Achilles heel of the whole NATO military doctrine of first use of "tactical" nuclear weapons.

Stop the development of the neutron bomb!

The greatest human right needed by the peoples of the entire world is freedom from the threat of nuclear war. The building of a secure detente is a necessary step in achieving this goal. The decision to develop the neutron bomb represents a further step in the escalation of the arms race and will make agreement on measures of disarmament more difficult. It poses a special threat in the first place to the people of Europe, but potentially is a threat world wide. The development of such a weapon, so eminently suited for aggression by order of President Carter, cannot fail to raise doubts everywhere about the real aims of the NATO alliance. The revulsion of the people of the United States and the other NATO countries must prevent the deployment of this weapon, must demand a reversal of the decision to develop it and help to restore faith in the protestations of the peaceful and purely defensive intentions of the governments and peoples of these countries.

About CND

CND campaigns for a world free of nuclear weapons and of all other weapons of mass destruction. CND's immediate policy is for Britain unilaterally to abandon nuclear weapons, and policies based on nuclear weapons, as a first step to the creation of a British foreign policy based on the principles of peace and co-operation. Such a policy will seek, as a priority, to rid the world of nuclear weapons.

CND also campaigns for British withdrawal from NATO, and for the winding up of both NATO and the Warsaw Pact.

CND is not only opposed to British nuclear weapons, but also to all other nuclear weapons, and campaigns against any international development which threatens the survival of the world.

In addition, CND is active on other matters relating to military and foreign policy.

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