

50507473

NUCLEAR ENERGY AND NUCLEAR WEAPONS:

INIS-mf--9617

SOME FEARS AND FACTS

J.A.L. Robertson

Atomic Energy of Canada Limited

Paper presented to the 23rd Annual International Conference of
the Canadian Nuclear Association,
Montreal, 1983 June 14

We all want to prevent the use of nuclear weapons. The issue before us is how best to achieve this objective; more specifically, whether the peaceful applications of nuclear energy help or hinder, and to what extent. Many of us in the nuclear industry are working on these applications from a conviction that without peaceful nuclear energy the risk of nuclear war would be appreciably greater.

Others, however, hold the opposite view. For some, the fear of a nuclear holocaust is so great that they automatically reject everything "nuclear", through word association, without any analysis whatsoever. Others correctly argue that there is some connection between the two nuclears through common materials, equipment and expertise. But they do not seem to grant the beneficial effects of nuclear energy and so do not perform even a conceptual cost/benefit analysis. To them, banning nuclear energy must seem logical. A similar argument would call for banning X-rays since they can cause cancer: The fact that they are also used to detect and cure cancer would be ignored.

In my experience of discussing this subject, a necessary step in allaying fears is understanding some facts, and indeed facing up to some unpalatable facts. Since I have both good news and bad news, let me start with the bad.

First the Bad News

Today, perhaps 20 to 30 countries have the materials and technical capability to make nuclear weapons without outside help. Many more could develop this capability within a few years. Chinese and Indian experience demonstrated that this capability is not restricted to industrialized countries.

The availability of uranium is no real problem since it is relatively abundant and widespread. Because only modest amounts are needed to produce the fissile material, or nuclear explosive, for a weapon a country could afford to pay a high unit price and hence to exploit its normally uneconomic ores.

Separating or producing the fissile material from the uranium also does not present an insuperable problem, at least in principle. Eight methods of doing this have been known for years. Similarly, the design principles of nuclear weapons are well known.

Shutting down all civilian nuclear reactors, those producing medical radioisotopes as well as those producing electricity, would not prevent a country that wants to acquire nuclear weapons from doing so. This can be illustrated by imagining that any peaceful applications had been banned from the start, in 1945. The world would still have the same five nuclear weapons countries as it has today since none of these used a civilian program to develop its weapons capability. (India constitutes a possible, but ambiguous, exception. In 1974, it set off a nuclear explosion but has not gone on to demonstrate or claim a weapons capability.) The problem of preventing the proliferation and possible use of nuclear weapons exists regardless of whether nuclear energy is exploited for peaceful purposes.

Even total nuclear disarmament, seen as an ideal by some, would not guarantee our safety. Since the knowledge of how to make nuclear weapons cannot be erased from human consciousness, a world without any such weapons could be held to ransom by a Hitler or an Idi Amin.

Vital to our future survival is a proper understanding that there are no panaceas. Specifically, I want to stress that there are no easy technical fixes. There is no way that we technical people, the scientists and engineers, can guarantee to prevent the proliferation or use of nuclear weapons. Anyone promising a simple solution is either confused or dishonest. Our world suffers from a surplus of simple solutions and a shortage of simple problems.

The Paradox

If the news is as bad as I have reported, why has no nuclear weapon been used in anger since 1945? Why has there been no addition to the nuclear weapons countries since 1964, during which time nuclear energy has grown to be producing about one-tenth of the world's electricity? Why have 115 countries become party to the United Nations' Non-Proliferation Treaty whereby those without nuclear weapons undertake to forego them?

The answer to this paradox is that the reasons for acquiring and using nuclear weapons are political, as are most deterrents to their use. In the discussion so far we have ignored the reasons for not using them. The problem of nuclear weapons, and the means of tackling it, are essentially political and hence the responsibility of all of us as citizens and not of any specific group. It is therefore incumbent on us to understand the facts.

If the technical community cannot provide guarantees, it can at least help in providing political solutions. And that brings us to the good news.

Now the Good News

The first piece of good news is that although there is a connection between nuclear energy and nuclear weapons, it is a very tenuous one. Thus, uranium can be used as the raw material for producing nuclear

explosives instead of fuel for electricity generating stations in the same way that crude oil can be used to produce napalm instead of furnace oil. Some types of equipment and areas of expertise are common to both applications, but the same could be said of a medical research laboratory and biological weapons.

The production of nuclear weapons would require considerable and diverse technical expertise not available in a civilian nuclear industry, as well as a supply of separated fissile material in a highly purified form that is not present in today's commercial fuel cycles. That the two technologies are decidedly different is a fact acknowledged even by critics of nuclear energy: Daniel Ford wrote in the 1982 October 25 issue of the "New Yorker" magazine "---nuclear reactors and nuclear bombs worked on very different principles; continuing research to develop the one, accordingly would have little benefit in terms of advancing the other." The difference is not great enough to provide any absolute guarantees, but it does open up the possibility of exploiting the benefits while controlling the risks.

In discussing countries that may acquire nuclear weapons, it is important to distinguish between two distinct categories since they require different responses: On the one hand, those that aspire to major power status and that would therefore require fully developed nuclear arsenals and the planes or missiles needed to deliver them; on the other hand, small countries that might want to possess a few nuclear weapons, perhaps for prestige, to threaten their neighbours or to deter aggression.

A country in the first category would require an efficient nuclear-weapons industry capable of producing tens or hundreds of weapons per year. Such capability could not be concealed. A country in the second category might be interested in a few weapons, even though these were unreliable and untested, without having the capacity for sustained production.

The difference in magnitude of the threats posed by the two categories is enormous. Joseph Nye, formerly of the US State Department, said that "the difference between a single crude device and a modern nuclear arsenal is as stark as the difference between having one small apple and having an orchard." It is only the major nuclear powers that have the potential for causing the so-called "Doomsday Scenario", even for destroying the human race; the second category could cause disastrous harm but on a localized scale measured in kilometres.

Preventing war between major powers should surely have highest priority. Here, the peaceful applications of nuclear energy do nothing to increase the existing risks, while actually decreasing the risk of these powers going to war over scarce oil supplies. By providing a new energy source just as oil is becoming scarce, we are reducing international tensions that could result in global war.

By 1985, those nuclear reactors already in operation or under construction will be producing an amount of energy equivalent to the total oil production of Saudi Arabia. This may still represent a small fraction of the world's total energy consumption, but just imagine what its loss would do to an already shaky world economy. Also, a sudden loss

of this magnitude is a real concern. One-third of the non-communist world's oil consumption passes through the Strait of Hormuz, which is 40 kilometres across but with a channel only three kilometres wide. Anything that makes us less dependent on such insecure energy supplies must surely contribute to world peace.

With the second category of country what is needed is some incentive not to acquire nuclear weapons. Several such incentives exist, mostly political, including defence treaties with a nuclear-weapons country. Here again, however, nuclear energy can make a positive contribution. The Non-Proliferation Treaty represents a bargain between the have and the have-not countries. It requires that nuclear-weapons countries negotiate in good faith toward the cessation of the nuclear arms race, toward nuclear disarmament and the goal of complete disarmament; that they not supply nuclear weapons to countries without them; and that they assist the non-nuclear-weapons countries in the peaceful development of nuclear energy. In return, a non-nuclear-weapons country agrees to forego nuclear weapons, and to accept International Atomic Energy Agency safeguards with their associated inspections of its nuclear energy facilities.

There is concern that nuclear exports could help countries in the second category acquire nuclear weapons. However, even if all nuclear suppliers denied exports, and even if all existing reactors were shut down immediately, the customer country could still go it alone. The basic problem of nuclear weapons would still be with us. The real question is whether the developing countries will introduce nuclear energy openly, for the benefit of their populations with our help and hence under international inspection, or on their own, not subject to inspection, and perhaps even surreptitiously. Again there are no guarantees of perfect safety, but peaceful nuclear energy supplied under international agreements offers us an advantage we would not otherwise enjoy.

Without the peaceful uses such a bargain would be impossible, and the control of nuclear weapons would present a problem no different from that of controlling any other weapons system, including chemical and biological agents. However, acceptance of international inspection represents a step without parallel in attempts to control other weapons systems, a step that is agreed to only in exchange for significant benefits.

The safeguards referred to represent another important contribution by the technical community, but their limitations should be understood. The average individual, unaware of any special meaning, could be expected to believe that safeguards offer some assurance of preventing misuse of nuclear materials, whereas all that is claimed for them is that they should be capable of detecting and hence detering any diversion of these materials. It is only when the limitations of safeguards are clearly recognized that the need for complementary political actions, such as sanctions against those detected diverting nuclear materials, becomes apparent. Safeguards can be compared to a burglar alarm. On its own, a burglar alarm can only detect crime and cannot prevent it, but can act as an effective deterrent.

In combatting weapons proliferation, safeguards mean a system of procedures with suitable equipment that provides, through International Atomic Energy Agency inspectors, independent confirmation that a country operating nuclear facilities can properly account for all relevant fissile material. Accounting procedures, with frequent stock-taking and reporting, form the basis for international safeguards. These are supplemented by containing the fissile material within secure confines and by surveillance of any access routes penetrating the containment. A variety of technical methods support these objectives.

In the final analysis, all methods of detecting diversion are ineffective without political will in the international community to invoke sanctions against those who breach their commitment to peaceful uses. Safeguards can deter diversion and the benefits of peaceful nuclear energy can be used as an incentive to discourage weapons proliferation, but neither of these measures offers a guarantee. The world community must be prepared to take action against any country misusing nuclear energy, and this is true whether or not there are any civilian nuclear reactors.

Striking a Balance

When the good news is weighed against the bad, it is obvious that we live in a dangerous and difficult world, but that there are reasons for optimism. We will improve our chances of charting a safe course through a perilous future if we understand the true nature of the perils, if we separate the fears from the facts. We can then see that the peaceful applications of nuclear energy are much more part of the solution to preventing nuclear war than they are part of the problem.