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АТОМ -- мирное использование

# The Atoms for Peace blunder by Leonard Beaton

*The first of two extracts from "Must the bomb spread?" by Leonard Beaton, to be published as a "Pelican" on January 27 at 4s.*

THE spread of nuclear weapons could be greatly accelerated if some cheap and simple method could be found for the enrichment of uranium. On the other hand, it is likely to be very much delayed if the major Powers are ready to devote their influence and power primarily to discouraging it. The decisions of many countries will be determined by what happens to their alliances. Others will govern themselves by their estimate of the prospects for disarmament.

Many technical issues will also be influential in government decisions, such as the development of missile technology, the availability of bombers and the amount of information which is published about gaseous diffusion and gas centrifuges. But none of these compares in importance with the prospects for a world-wide spread of plutonium. This is likely to be fundamental to the spread of nuclear weapons in the next generation. Indeed, there is a strong possibility of a spread of plutonium independent of any question of nuclear weapons. If this happens, increasing numbers of countries will possess effective nuclear explosives which they can fabricate into weapons at any time they feel they must.

The spread of plutonium is directly related to the spread of large nuclear reactors either for the production of power or for other purposes connected with desalination of sea water or various chemical processes. It might be thought that all the resources of those who fear the spread of nuclear weapons would have been devoted to heading off these developments for as long as possible. . . .

In fact, the history of the last twelve years has been precisely the opposite. What amounted to the spread of plutonium capacity was spectacularly launched by President Eisenhower in his "atoms for peace" proposals of December 8, 1953: and the efforts which have followed must stand as one of the most inexplicable political fantasies in history. Only a social psychologist could hope to explain why the possessors of the most terrible weapons in history should have sought to spread the necessary industry to produce them in the belief that this could make the world safer. He would need a profound understanding both of the nature of collective guilt and of the unusually strong attraction which the American political system can show for an apparently idealistic gesture with important industrial implications.

What followed was worthy of the beginning. For ten years, the United States and her allies (with the perplexed Russians following along behind) have set out to train in nuclear technology the scientists of countries whose main problems are in many cases agricultural; and they have put great resources into trying to prove, in the face of the facts, that nuclear power was on the verge of becoming cheaper than conventional power.

## Suicidal course

The strange thing is that it is private industry, especially in the United States, which has come to the rescue of governments who were determined on this suicidal course. While official estimates and public money in many countries were working for the spread of nuclear reactors, there was vigorous opposition from the oil and coal industries, the railroads, and others. They brought the costs of oil-fired and coal-fired power stations steadily down. Their success was so obvious and indisputable that vast plans for the expansion of nuclear power stations have had to be drastically reduced.

The United States itself had by 1964 achieved only half the electrical generating capacity in nuclear reactors which it had originally planned for 1955. Apart from a certain amount of development in Italy, virtually the whole gigantic Euratom-American "Joint Program" to cover Western Europe with nuclear power stations has been scrapped. The British plans have been consistently cut back. Economics have won an almost complete victory in the first round. What may be decisive is whether they have converted governments to a policy of restraint. They may not win another round against such heavy odds.

The thermal rating of a power reactor is generally a little more than three times its electrical rating. A rule of thumb exists for converting each of these into an approximate potential for plutonium production. For each mW(th), a reactor will produce one gramme of plutonium a day while it is operating. If as a general rule a reactor will work about 250 days in the yea[r] each 4 mW(th) will produ[ce] one kilogram of plutonium [a] year. If a bomb design tak[es] five kilograms of plutonium, [a] 20 mW(th) reactor will pr[o]duce enough for one a yea[r]. It is usually assumed th[at] plutonium weapons nee[d] between four and seven ki[lo]grams of fissile material.

The rule of thumb for el[ec]trical ratings is that for eve[ry] 1,000 mW(e) a reactor w[ill] produce one tonne (or 1,0[00] kilograms) of plutonium [a] year. In other words, the[re] can be one kilogram a ye[ar] for each megawatt. Applyi[ng] these somewhat simplifi[ed] principles to the existing re[ac]tors, we get the tables wh[ich] follow (the table on resea[rch] reactors has here be[en] omitted):

**POWER REACTORS**

| Country | Name | Foreign Patron | Rating (electrical mW) | Uranium Enrichment | In Operation | Possibl[e] Bombs Per Ye[ar] |
|---|---|---|---|---|---|---|
| Belgium | SENA | U.S. | 280 | 3.1% | 1965 | 56 |
| Canada | CANDU | none | 220 | natural | 1964 | 44 |
| | HWR-1800 | none | 900 | natural | 1970 | 180 |
| Czechoslovakia | HWGCR | U.S.S.R. | 150 | natural | 1970 | 30 |
| India | Tarapur | U.S. | 380 | slightly enriched | 1968 | 76 |
| | Rajasthan | Canada | 200 | natural | 1969 | 40 |
| | RAP-2 | none ? | 200 | natural | 1970 ? | 40 |
| | Madras | none ? | 400 | natural | 1972 | 80 |
| Italy | Latina | U.K. | 230 | natural | 1962 | 46 |
| | SENN | U.S. | 160 | 1.6-2.1% | 1963 | 32 |
| | SELNI | U.S. | 270 | 3% | 1964 | 54 |
| Japan | Tokai-Mura | U.K. | 166 | natural | 1965 | 32 |
| | Tsuruga | U.S. | 300 | some enrichment | 1968 | 60 |
| Netherlands | SEP-BWR | U.S. | 50 | slight enrichment | 1967 | 10 |
| Sweden | R-4/EVA | none | 160 | natural | 1968 | 32 |
| West Germany | KRB | U.S. | 250 | 2.6% | 1966 | 50 |
| | KWL | U.S. | 240 | some enrichment | 1968 | 50 |
| | KBWP | none | 240 | 2.5-3% | 1968 | 50 |
| | HDR | none | 25 | 3% | 1968 | 5 |
| | KKN | none | 100 | natural | 1968/9 | 20 |

(MORE)

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# Action and reaction by Leonard Beaton

*The second of two extracts om "Must the bomb spread?" y Leonard Beaton, to be pubshed as a Pelican on January 27 : 4s.*

[T]HE means by which reactors could spread without necesarily spreading weapons have een studied since 1945. From ie start, there has been a strong onviction that the essential hings to control were the basic iinerals right through to the ime when they become fissile iaterials. Originally, it was oped that the sources of ıranium in the world might be ery limited and that it might e possible for an international uthority to get control of them.

The 1946 Baruch Plan was ased on the idea of buying or easing all uranium mines on an nternational basis. Its whole ipproach sought to make the reatest possible use of what was hen believed to be an important cientific fact. This was that if iatural uranium was left in a eactor for long enough it began o develop increasing quantities f plutonium 240 in addition to lutonium 239 (the material used or weapons). It was believed at hat time and for many years fterwards that if more than a ertain proportion of plutonium 40 was present the plutonium vould cease to be an effective xplosive. In the jargon, it would io longer be weapons-grade plutonium.

The most convenient technical consequences flowed from this. All that an inspector had to do was to see that a charge of uranium remained in a reactor longer than a certain period and he could abandon all interest, knowing that it had ceased to have military importance. Equally, a stockpile of plutonium —indeed the contents of a bomb, if one wanted to disarm—could be contaminated by mixing in plutonium which was rich in plutonium 240. To reverse this process, to separate plutonium 239 from 240, would present the same problem of sorting out heavier atoms from lighter ones as has been experienced for uranium 235 and 238.

There is now unfortunately a great deal of evidence to suggest that this theory was fallacious. The most important is the pricing practice of the United States Atomic Energy Commission. Until July 1, 1962, it paid $45 a gram to reactor operators for plutonium which was more or less pure 239. If the amount of plutonium 240 exceeded 8.6 per cent, the price paid was only $30 a gram.

After July 1, 1962, a standard price was paid for all plutonium no matter what its proportions of 239 and 240. In a valuable study of this question, Arnold Kramish of the Rand Corporation says that "the addition of denaturants to bomb materials has received no further consideration in disarmament discussions" and "denaturing is no longer considered effective." All plutonium must henceforth be assumed to be a potential explosive.

## Extensive links

Although this particular avenue of demilitarisation has disappeared, the work of establishing safeguards has gone slowly forward. At the same time as they have stimulated the proliferation of nuclear knowledge and facilities, the American, British and Canadian Governments have tried to ensure that formal safeguards against weapons use backed by inspection were applied to fissionable or fissile materials which crossed frontiers —and also to reactors in which an outside country plays an important part. This might be thought to miss most of the major industrial powers: but the extensive international links in this technology are evident if one looks at the nuclear weapons programme of any of the nuclear powers.

Both the British and the Americans depend heavily on Canadian uranium (though the Americans early discovered large quantities in the United States). The Soviets are believed to have imported large quantities of uranium from Eastern Europe, especially Czechoslovakia and East Germany. The Chinese had a long period of close cooperation with the Soviet Union. France has supplemented her domestic uranium supplies with imports from Madagascar and Gabon and is now likely to import what she needs for civil reactors so as to leave French-controlled sources available for weapons.

The sale of American and British uranium and reactors (except to themselves) was safeguarded by inspection. This principle was applied to individual contracts on a bilateral basis and the International Atomic Energy Agency applies safeguards if two contracting countries ask for them. There is, of course, nothing to stop international arrangements without safeguards.

The safeguards system has undoubtedly had some effect in discouraging proliferation to a number of countries. So far, the market for uranium has not apparently become free; and the credit for this undoubtedly goes to Washington. In spite of the extreme difficulty which the IAEA had in coming into existence and in having its Statute adopted, it now exists and carries out certain inspection functions. These are, of course, confined to ensuring that agreements not to use fuel or facilities for weapons purposes are not broken.

The IAEA has no part in any national programme and no one has questioned the complete freedom of the United States, India or other countries where the use of the products of their own mines and their own reactors are concerned. There is equally no control over fissile material where it has been sold without controls. The IAEA is merely a piece of machinery which Governments can use to see that a "peaceful uses" clause in a bilateral agreement is not abused.

Even this has been the subject of strong opposition.... The long fight in the Agency over its safe guards system may have servec to show just how powerful the existing nuclear powers can be i they are sufficiently determinec on an objective.

The Agency ought to b capable of development for an purpose, but it should be recog nised that (like national Atomi Energy Commissions) it exists t promote the development o atomic energy. It shall, unde its Statute, "seek to accelerat and enlarge the contribution o atomic energy to peace, healt and prosperity, throughout th world," ensuring, so far as it i able, that its assistance is nc used "to further any militar purpose."

## Concerted effort

These objectives make it th United Nations version of th expensive national atomic energ agencies which appear so often t be lobbies maintained at publ expense to stimulate the sprea of atomic energy. Its governo and advisers seem in many cas to belong to that honourable b naïve school of opinion whic believes as a matter of faith th the advance of atomic ener must be beneficent and no military whatever the facts of th case may be.

If the IAEA is to form part a concerted effort to stop t spread of nuclear weapons, may have to cast its weight on the other side of the scale Resources will have to be spe by it or by someone else to pro that conventional fuels are mo not less, economical for powe to improve the efficiency desalination techniques which not involve the production plutonium, not those that produ large quantities of plutoniun and to find how plutoniu producing facilities which mu inevitably spread around t world can be organised so as prevent the accumulation pools of this immensely powerf substance in country aft country.

(END)