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WORLD -- THE TERRIFYING PROSPECT: ATOMIC BOMBS EVERYWHERE F.- 554

Munich, May 3 (CND) -- the following article by Daniel Yergin, appeared in The Atlantic Monthly, April 1977

Today just six nations possess nuclear weapons, but soon the number could multiply dramatically. The spread of "peaceful" nuclear technology has ironically provided the means for dozens of countries to develop atomic arsenals. Can anything be done to avert the Age of Proliferation?

In an automobile accident there is the long moment before impact, when you see the other vehicle coming toward you, and you realize that a collision is imminent, and yet you cannot believe that it is going to happen. At last, you hear the sound of colliding metal, and you know that it is too late.

The people of the world are at such a moment, on course for a nuclear collision. The question is whether it is already too late to change direction. Nuclear warfare has been a possibility for more than three decades. But suddenly the threat has intensified—not because of political instability, but simply because of the prospect of widespread proliferation of nuclear armaments. It is not too much to say that we are entering the Second Nuclear Age—the age of proliferation.

While many countries use nuclear energy as a source of power, there are only six "nuclear weapon states" today—the United States, the Soviet Union, Britain, China, France, and India. But recent technical, economic, and political changes have brought nuclear weapons within easy reach of many others. Israel seems very close to a nuclear weapons capability though it feels safer being secretive on the subject. A host of other countries could soon qualify for admission to what newspapers call "the nuclear club"—countries such as South Korea, Iran, Pakistan, South Africa, Brazil, Argentina, Taiwan, and Spain. Turkey's defense minister has publicly discussed his country's developing nuclear weapons and the Yugoslav Communist party newspaper not long ago suggested that some atomic bombs would contribute to that nation's security. A number of Arab countries are exploring ways to obtain nuclear weapons. Libya's president has said that in the future "atomic weapons will be like traditional ones, possessed by

every state according to its potential. We will have our share of this new weapon." So eager is Libya that a few years ago it actually went shopping for a bomb. Both France and China are reported to have refused to sell.

In the First Nuclear Age, a country that wanted a bomb had to mount an expensive, complex program. In the Second Nuclear Age, a country acquires the capability to produce a nuclear weapon with relative ease—as a by-product of developing nuclear power. According to present plans, some forty countries will have nuclear energy programs by 1985. Each program would produce enough nuclear material for three or more bombs. Most of them would have enough material for thirty or more bombs.

Looking to 1990, projections indicate that reactors in the Third World alone could be producing enough nuclear material for 3000 Hiroshima-sized bombs a year. In such circumstances, so-called "subnational" groups—terrorists—could take as hostages not planes but a reactor, or even an atomic bomb, or nuclear waste products, and then their terror would reach to an entire city or even a nation. The problem gets worse year by year. In 1995, up to a hundred nations could have the knowledge, facilities, and raw materials that, with a little extra effort, would enable them to manufacture a bomb.

David Lilienthal is now seventy-seven years old. His experience with nuclear energy goes back almost to its beginnings. In 1946, he helped to draft America's first plan to control nuclear weapons and became the first chairman of the Atomic Energy Commission. He once shared the dream that the atom could bring good as well as bad into the world. But he now looks with something akin to horror at what is happening. He recently described the proliferated world as "the terrifying prospect for the young

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men and women who are looking forward to a future."

"I am glad," he added, "I am not a young man, and I am sorry for my children."

HOW WE GOT TO WHERE WE ARE

There were just three nuclear devices in the summer of 1945. The first, called "Trinity," was detonated in the New Mexico desert in July, proving that an atomic bomb would work. It was quickly followed by "Little Boy" over Hiroshima and "Fat Man" over Nagasaki. The American atomic arsenal was depleted, but it did not matter, for it had brought an end to the war with Japan. The First Nuclear Age had begun.

In 1945 there was still only one nuclear weapon state, the United States, which went on producing bombs. Right from the beginning, two questions dominated all considerations. Who else would develop a bomb? And when? American leaders tried to find a way to keep the fearful new invention under surveillance. By the end of 1946, it was clear that the United States and the Soviet Union would not be able to agree on an international control system.

President Truman confidently pronounced the American monopoly a "sacred trust." Most U.S. leaders assumed that it would take the Russians many years to achieve their own capability. (A number of scientists did not agree.) The illusion was shattered in early September 1949, when it was learned that the Russians had successfully detonated an atomic device in Siberia in late August. So then there were two nuclear powers, and a process of mutual deterrence was begun.

The British felt they had been deprived of the payoff for their wartime collaboration on atomic developments with the United States. They could hardly be a Great Power without nuclear weapons. (The British chiefs of staffs had privately warned: "To have no share in what is recognized as the main deterrent in the Cold War and the only Allied offensive in a world war would seriously weaken British influence.") So on October 3, 1952, they tested a bomb on the Monte Bello islands off Australia. Now there were three atomic weapon states.

The French, especially under De Gaulle, also

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wanted to maintain the Great Power status, and they were not going to depend on the "Anglo-Saxons." They exploded their bomb in the Sahara on February 13, 1960. "Hurrah for France!" De Gaulle telegraphed the French minister in charge. Now there were four nuclear weapon states.

Between 1955 and 1959, the Soviets provided their Chinese comrades with nuclear know-how. In 1959, as the Sino-Soviet rift developed, the Russians withdrew their assistance, but it was too late. "Whether or not nuclear weapons help peace depends on who possesses them," the Chinese announced in 1963. And on October 16, 1964, the Chinese exploded their first nuclear weapon in the Takla Makan desert in the province of Sinkiang.

There were now five nuclear weapon states. They continued to test atomic and hydrogen bombs, to perfect them, and to increase their number. They developed stockpiles, as well as the planes and missiles required to deliver the bombs from the country of manufacture to their targets. But no new players joined the game. In the possession of nuclear weapons by these five, there seemed a kind of stability, a mutual deterrence. There was even something symmetrical and fitting about it, for the five were the Great Powers. Attention shifted to such issues as limited war, guerrillas, regional conflicts, nationalism, while proliferation and nuclear dangers receded as subjects of concern. That situation lasted for almost a decade after China's first explosion, that is, until May 18, 1974.

THE SECOND NUCLEAR AGE

On that day, shortly after nine in the morning, the Indian foreign minister received a phone message "The Buddha is smiling." An hour or so earlier, in an underground site in the Rajasthan desert, a hundred miles from the Pakistan border, the Indian Atomic Energy Commission had set off a nuclear device. It was officially announced to the world as a "peaceful nuclear explosive experiment." But there is no discernible difference between a "peaceful nuclear explosion" and the detonation of a prototype for an atomic bomb. Indeed, no satisfactory peaceful use has yet been found for nuclear explosions. India had become, in the words of an official in the U.S. Arms Control and Disarmament Agency, "a fourth-rate nuclear power." The Indian device was similar in design and power to the Nagasaki bomb, and, while lacking a large arsenal or sophisticated delivery systems, India is certainly more advanced than the

United States was after Hiroshima and Nagasaki. Mrs. Gandhi congratulated her scientists: "They worked hard and have done a good, clean job." The Indian newspapers headlined, "Nation is Thrilled" and "Indian Genius Triumphs." Canada, which had shared its technology with India, expressed shock that a country with so many economic problems, and in the face of assurances it had given Canada, would waste precious resources in order to develop nuclear weapons. The Indians said they had not violated any assurances because they had used uranium mined in India to make the explosive. Canada suspended and then canceled its \$100 million a year assistance program with India.

The Indian test in the Rajasthan desert ushered in the Second Nuclear Age. It dramatized the fact that we could soon be living in the midst of what has been called "a nuclear weapons crowd." As the director of the Indian Institute for Defense Studies reminded the rest of the world, "The nuclear powers thought they could simply lock up technology. It was absurd."

Powerful forces have promoted the spread of nuclear technology. To make sense of them, we need first to back up several months from the Indian explosion to the "October Revolution" effected by the OPEC oil cartel in the autumn of 1973. The October Revolution revealed several dangers to most industrial and developing countries. These countries were highly vulnerable for they were dependent primarily on a small number of Middle Eastern producers for their supplies. The price hikes delivered a stunning blow to their economies, and many people became convinced that the world will run out of oil within a few decades.

Fortunately, or so it seemed at the time, a "deus ex technologica" was standing in the wings to rescue the world from dependence on OPEC oil—nuclear power. "With the increase in the world of both population and industrialization, we will have no choice for the years after 2000 but to accept nuclear energy," observed a senior official concerned with energy for the European Community in the autumn of 1975. "Everybody is convinced that after 1980 nuclear energy will develop very quickly."

But as the renewed drive for nuclear power took shape, relatively few people were willing to face up to a most alarming fact—that when a country develops a nuclear capability, it is much of the way toward developing a nuclear device. "A great many countries," the strategist Albert Wohlsetter of the University of Chicago has pointed out, "as a result of their civilian nuclear energy programs and the policies of nuclear exporters, can come within days or hours of assembling nuclear explosives without

plainly breaking any of their promises to abstain from making or receiving them."

"There are not two atoms, one peaceful and one military," he said. "They are the same atom."

THE PLUTONIUM ECONOMY

The central problem is the "nuclear fuel cycle." This term suggests something pleasing, fulfilling, natural. It is not natural, for it involves tampering with natural uranium to create a new form of uranium as well as a number of elements that do not exist in nature and are very dangerous.

The cycle has, depending on how detailed one gets, between seven and eleven steps. The first several involve the mining of uranium and its preparation for the reactor. Then comes its actual use as fuel. The last steps involve the storage and disposition of the nuclear waste—that is, the leftovers after the uranium has done its job.

Two points in this fuel cycle intersect with the manufacture of an atomic bomb. Both stages produce what is variously known as fissionable or "fissile" material, which could be used as an explosive rather than a source of nuclear power.

As it is mined, uranium is not quite suited for nuclear reactors. It consists mostly of the stable U-238, with typically a .7 percent concentration of the isotope U-235. It needs to be "enriched" to about 3 percent U-235 in order to sustain a controlled chain reaction in the type of reactor developed in the United States. A nation that has enrichment facilities can go ahead and enrich the uranium to a concentration of U-235 much higher than 3 percent. Then it is in a state suitable for use as the explosive core of an atomic bomb. Highly enriched uranium was the material used in the Hiroshima bomb.

Further along in the fuel cycle, at what is called the "back end," after the enriched uranium has been consumed, there is the nuclear waste or ash, containing many different radioactive and toxic materials. Some of these wastes can be "chemically separated" and used again as fuel in the reactor. The two principal materials so recoverable are uranium and plutonium, a man-made element. Plutonium was the substance of the Trinity and Nagasaki bombs.

The most intense concern today focuses on the plutonium at the back end. Uranium enrichment is a costly, complex process. While it is not easy to extract the plutonium from the other wastes, it can be done through what is now the rather standard and less costly process of chemical separation. So even

nations dependent on outside sources of enriched uranium can use it to produce their own plutonium.

Plutonium is the nub of the proliferation problem today. It has two uses. It can be separated for use as a fuel in a reactor, and there are those who think such plutonium will become a major nuclear fuel in the future. (Currently, reprocessing for this purpose is being carried out only on a small-scale developmental basis in Europe and the United States. No one has yet found this procedure economical.) But plutonium can also be used as one of the two basic materials for an atomic bomb.

The important point is that no country need decide that it specifically *wants* to accumulate stocks of plutonium. In buying a reactor from country Y, country X does not have to make a conscious decision to acquire nuclear weapons. The thought can be a mere haze, neither analyzed by planners in the foreign ministry nor costed by the economists in the budget office. The opportunity is simply handed over with the keys to the reactor. All that needs to be done is to start up the reactor, and plutonium becomes one of the country's resources. The plutonium used in the core of the Indian bomb was chemically separated from the radioactive exhaust materials produced in reactors outside Bombay.

A good-sized but still standard reactor could produce 200 kilograms of plutonium a year, while a crude implosion bomb requires a mere ten kilograms of plutonium. It is the contrast between these two numbers that causes so much alarm. For they indicate that a satisfactorily operating atomic reactor would produce enough material for the explosive core of a bomb every two or three weeks. And in *The Last Chance*, his new book on proliferation, William Epstein suggests that a plant for separating plutonium for the purpose of making a bomb could be constructed for as little as \$3 million. If current plans and developments for nuclear power go ahead, there will be such a plutonium glut—as a source of fuel, in international trade, and in waste products—that people have begun to speak of the dangers of a widespread “plutonium economy.” Plutonium will become extravagantly widespread if the breeder reactor comes into use.

“The real problem of proliferation today is not that there are numerous countries ‘chomping at the bit’ to get nuclear weapons,” Albert Wohlstetter noted. “But rather that all the non-nuclear nations, without making any conscious decision to build nuclear weapons, are drifting upward to higher categories of competence.”

Of course, a nation that has neither enrichment nor reprocessing facilities would find it very difficult

to do anything with its fissile material except use it as a source of power. Therefore, much of the thinking about proliferation focuses on ways to “safeguard” enrichment and reprocessing.

INCENTIVES

The October Revolution gave another kind of boost to atomic energy. The East-West split has been the historic impetus for the nuclear arms race of the last three decades. The United States, Britain, and France on one side, and the Soviet Union and China on the other, built up their stockpiles primarily to deter the other side. (Although, in the last several years, China and Russia of course have also been deterring each other.) But the October Revolution dramatized a different division—between North and South—pitting the industrial world in the Northern Hemisphere against the Third World “developing nations” in the Southern Hemisphere. In the United Nations and many other councils, the Third World countries have been asserting their independence, declaiming on the subject of their equality, and, in general, blaming the First World for all their problems. Some of them believe that the acquisition of nuclear weapons is one of the most visible ways to assert their power and influence. It does no good for Westerners to express worry about the dangers for everybody in the spread of nuclear weapons, for the Third World snaps back (in the words of a leading Indian spokesman) that such concerns are merely “modern versions of the doctrine of the white man's burden.” Nuclear weapons are taken as a sign of prestige and influence. After all, it was not Mrs. Gandhi but Charles de Gaulle who announced, on the day of its first nuclear explosion, that France was “stronger and prouder since this morning.” But it is not only countries such as India that want to augment their prestige and influence with nuclear weapons. Now, as a result of the drastic increase in oil prices, a country such as Libya has not only the desire and egoism but also the wherewithal in cash to buy nuclear technology. It is unsettling, to say the least, to think of nuclear weapons in the hands of Libya's leader, Qaddafi, who even in the Arab world is thought of as erratic (“a mental case,” Anwar Sadat has called him). “It is well known that Qaddafi would like to have an atomic weapon,” said a CIA analyst. “Some people think he is too irrational and unstable but he has shown himself rational enough in managing Libya.” Having failed to buy a bomb, Qaddafi is now reported to be trying to assemble

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Arab nuclear scientists to develop his own nuclear weapons capability.

There are more specific incentives at work as well. Such countries as India, Brazil, and Iran are striving for what is now known as "regional hegemony." Nuclear weapons are one way to assert their seigniorial rights. But such steps of course only encourage further proliferation. Just as China's nuclear test in 1964 helped induce India's effort to make the bomb, so India's test a decade later had much the same effect on Pakistan, whose prime minister warned that if India took any more steps in the direction of building an atomic arsenal, "We will eat leaves and grass, even go hungry, but we will have to get one of our own." Pakistan is now strenuously seeking to assure itself that it too has the weapons option. Iran has indicated that if other countries in the region come into possession of nuclear weapons, Iran will also develop them. The shah has said, "If every upstart in the region acquires atomic bombs, then Iran must have them as well."

For some there is the most basic incentive to go nuclear—to buttress national survival. Three million Israelis face a mostly hostile Arab world of over 100 million people. The nuclear weapon is the deterrent of last resort, and Israel may now be only "a screwdriver's turn away" from having a nuclear capability. But the Israelis have never said they have any bombs, for that would only increase the Arab urgency to obtain their own. The Israelis have concluded that, for the time being, their best deterrent is one clothed in calculated ambiguity.

There is a final incentive. For decades a number of nations have lived and prospered under America's "nuclear umbrella." It has been understood, or implicitly guaranteed by treaty, that if their security is at stake, the U.S. nuclear arsenal stands behind them. But the umbrella has lost some of its covering in recent years. South Korea is not sure that it is protected anymore. Taiwan worries that it will soon be excluded. Therefore, as nations fear that they will be standing in an exposed place, they are sorely tempted to raise their own umbrellas, to develop an independent deterrent.

LIVING IN A NUCLEAR CROWD: BAD DREAMS

Even if we cannot predict how a conflict might occur, we can develop the likely possibilities.

(1) *Undermining the balance of terror.* So long as there was a sharp distinction between the nuclear weapon states and all the rest, a kind of stability—absurd but real—prevailed. The superpowers have, at

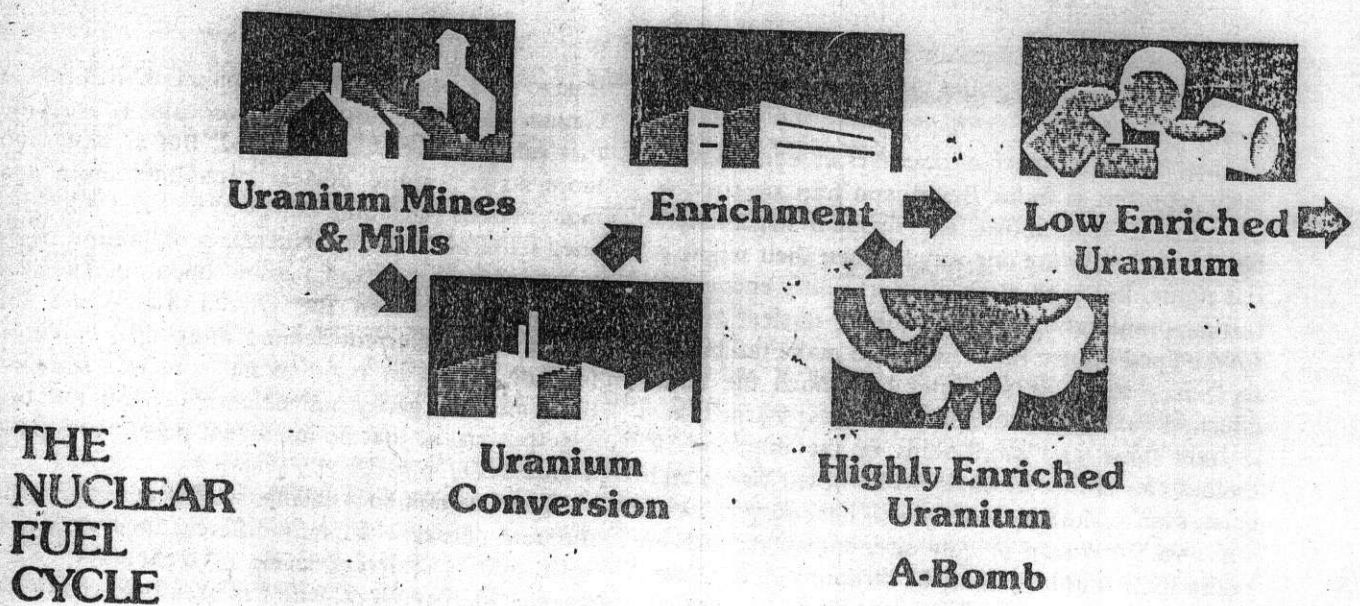
least to date, been in agreement on an implicit rule to contain crises. The closest they ever came to breaking that rule was over Cuba in 1962. But as more and more states acquire nuclear capability, more and more nations (including our own) will feel a heightened sense of insecurity. Nuclear proliferation raises havoc with all the calculations about the nuclear relationship between the United States and the Soviet Union. Current defense thinking is based on the notion that in order to have nuclear stability, there must be parity and balance between the two superpowers, so that no intelligent person will make a mistake.

"There cannot be a balance where there are many different parties with many different objectives, and with entirely different levels of technology," says scientist Herbert York, who has been involved in the American atomic weapons program since World War II. "So if there is—and there does seem to have been—a stability in the nuclear relationship between the United States and the Soviet Union, the stability will be wiped out by proliferation. Even its theoretical underpinnings will be wiped out."

On a visit to China before he became secretary of state, Cyrus Vance pointed to one form of the danger when, in a discussion with Teng Hsiao-p'ing, he said, "The hazards of accidental launch are real and could have devastating effects if one didn't know where the weapon was launched from. Accidental launching will become more likely with the indiscriminate spread of nuclear weapons."

(2) *The chain reaction.* One can easily imagine Israel being pushed to the wall. Arab forces are advancing on Tel Aviv. The Israelis begin assembling nuclear weapons. The Russians learn of this and dispatch warheads to Egypt. The United States in turn detects the Soviet warheads in transit. And the world is on the edge of destruction. But the chain can start with any client states. Both Iran and Iraq could become nuclear weapon states. A border clash between them could escalate into a nuclear exchange between the two countries, one of them a key American ally, the other tied by treaty to the Soviet Union. How long could the superpowers stay out? Where would it all end?

(3) *The easing of the taboo.* The world slowly becomes accustomed to the idea that nuclear weapons are not merely for deterrence, but actually of considerable value in a war. Perhaps India and Pakistan go to war, or Brazil and Argentina. Each side uses nuclear weapons, millions are killed, but one side emerges a decisive winner. While the superpowers are not drawn in, this spectacle reduces the taboo and makes it easier for other ambitious leaders to contemplate the use of nuclear weapons.



There is also the Crazy State model. A Libya or a Uganda, almost like a terrorist, could in the future use its nuclear bombs as a bargaining chip to achieve some bizarre and self-aggrandizing aim.

(4) *Microproliferation.* A terrorist group or even the Mafia attempts to steal plutonium—despite the toxic risks—from either a power station or a reprocessing plant, or while it is in transit. This they use to blackmail one or more governments, either for money or for some political aim. Physical security is never perfect. Not long ago, a lunatic walked unnoticed into the control room of a French nuclear plant and randomly threw several switches before being detected. Such a danger is so real that in the United States guards now have shoot-to-kill orders at fourteen federal nuclear installations. As the number of power stations increases, as the trade in nuclear materials and the plutonium economy expand, and as a covert, semilegal “gray market” in sensitive items grows, the threats become so serious that they result in security measures that have a corrosive effect on democratic institutions, for people come to fear that the dangers could not be met without a more authoritarian political system.

The microproliferation threats, however, are more likely to occur in the unstable political systems of the Third World. Thomas Schelling of Harvard University engaged in some chilling speculations in a recent issue of the journal *International Security*. How different might the course of events have been in Lebanon in late 1975 and early 1976, he asked, had that country had even a small pilot plant for extracting plutonium from spent fuel? “Who would have guarded the facilities? Who would have destroyed them, from nearby or from afar, at the risk of spreading deadly plutonium locally to keep bomb material from falling into mischievous hands? What

outside country might have invaded if the spoils of war would have included a nuclear-weapon capability, even only to deny that capability to some other greedy neighbor? †

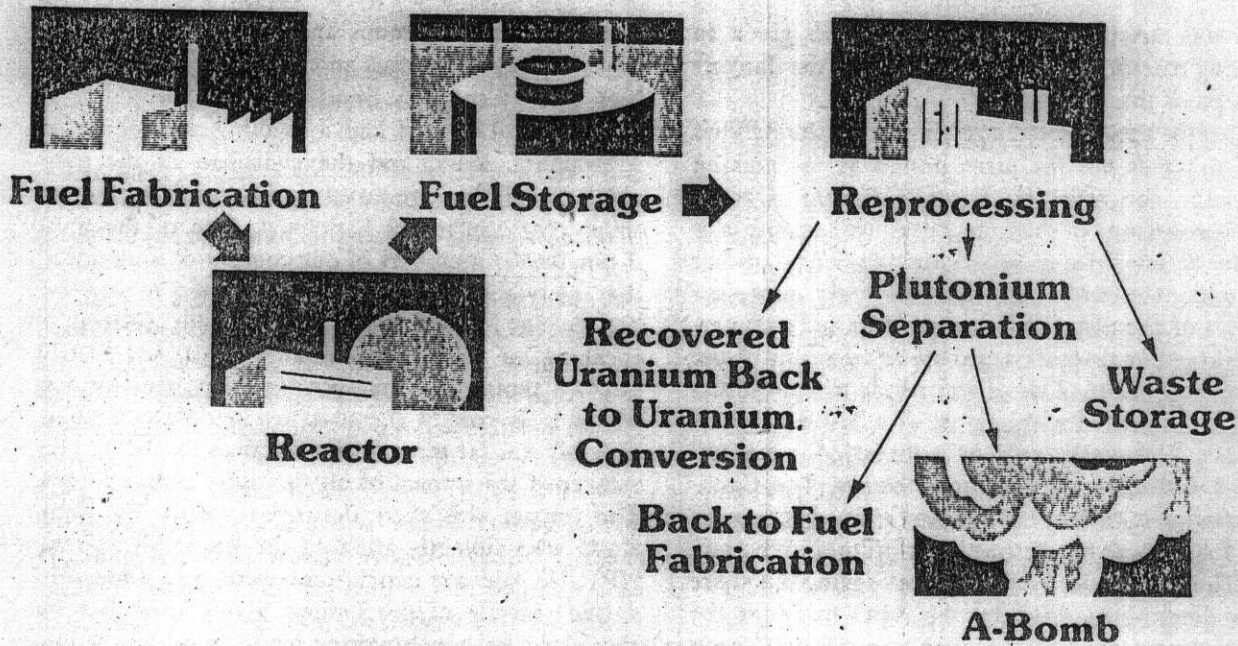
“One thing is certain: in years to come there will be military violence in countries that have sizable nuclear power industries.”

Perhaps such possibilities will encourage some caution. Would the president of Egypt or the shah of Iran really want to live with the risk that a terrorist group, or some ambitious colonels, might seize control of the country’s atomic bombs in the course of attempting a coup? Argentina has already had a foretaste of what microproliferation can mean. Not long ago a group of terrorists temporarily seized a nuclear power station (still under construction) some sixty miles north of Buenos Aires.

(5) *New patterns.* We still tend to think that all major nuclear developments will involve advanced industrial states. But one can see the outline of new “atomic alliances” crisscrossing the world. Already, it is reported, Argentinian scientists are at work in Iran’s nuclear program, and Egyptian scientists are being trained at the nuclear facility that gave India its device. (India has also noted that after its test, it received discreet inquiries from several countries interested in buying a bomb. The Indians say they refused to sell.)

AMERICA'S TWO ATOMS POLICY

From 1949, when the Americans realized that the Russians had the bomb, until 1974, when the Indians *(MORE)* exploded their device and the Buddha smiled, prolif-



eration was not of much concern in Washington. This omission seems very odd from the perspective of 1977. After all, one would think that the United States, as progenitor of nuclear weapons and nuclear power, would have had some proprietary interest in the subsequent spawning and that special attention would be given to the relationship between atomic power and the atomic bomb. Such was indeed the case in the years immediately after World War II. In 1946, Robert Oppenheimer pointed out that the "heart of the problem" of international control was "the close technical parallelism and interrelation of the peaceful and the military applications of atomic energy."

But this connection was quickly forgotten. After Hiroshima and Nagasaki, there was a powerful emotional drive to find peaceful uses, something good to do with the atom, in order, somehow, to compensate for its horrors. Furthermore, once the Russians had the bomb, the worst seemed to have happened, and fears about the spread were forgotten. There were also strong economic incentives. And so, in 1953, President Eisenhower proposed Project Plowshare and Atoms-for-Peace. The next year, the United States approved the export of nuclear power technology to other countries.

Thereafter, American interests in this realm were defined by a nuclear energy Establishment: government agencies such as the Atomic Energy Commission and the Defense Department; the congressional Joint Atomic Energy Committee; and such powerful industrial allies as Westinghouse and General Electric. Both the AEC and the Joint Committee were committed to the "maximum" utilization of atomic energy. The Joint Committee may well have been the most powerful congressional committee in history. It certainly did a masterful job of pushing a dispropor-

tionate share of government research funds into nuclear energy, to the detriment (as we know today) of other forms of energy research. Since the Establishment wanted to promote nuclear power on a worldwide basis, little thought was given to proliferation or to nuclear waste disposal. It has only recently been discovered that the Atomic Energy Commission lost track of sizable quantities of weapons-grade material leased to a score of foreign countries in the 1950s and 1960s. "For twenty years," said Victor Gilinsky, a member of the Nuclear Regulatory Commission, "[the nuclear export bureaucracy] had been freewheeling through the domains of diplomacy and international commerce—out of public view, and under the protection of a myopic Atomic Energy Commission and its own congressional committee."

When an organization or a group of organizations wants to "sell" something badly enough, whether it be nuclear power or a new drug, eyes tend to be shut to possible side effects, especially if they seem far off. Such is what happened with the Atoms-for-Peace program. "Many mistakes were made in the way we executed the idea," observed Fred Ikle, former director of the Arms Control and Disarmament Agency. "We now can see many forks in the road, many turning points where we could have taken a different technological direction. We could have chosen a course that might have greatly reduced the risks of nuclear proliferation without any loss in terms of economical operation of power reactors."

But we did not. The conventional American reactor, the so-called light-water reactor, is, after all, a spin-off from the World War II atom project, for which plutonium was a highly desired end product, and, more directly, from the subsequent development of the Navy's nuclear-powered submarines.

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Habit was strong, and little thought was given to designing reactors that would not involve the dangerous steps in the fuel cycle.

"What is used for reactor design in the United States today is not the same design as for making plutonium for military purposes," said George Kistiakowsky, one of the most prominent scientists in the Manhattan Project, subsequently science adviser to President Eisenhower, and currently professor emeritus of chemistry at Harvard. "But our commercial light-water reactors are derivative copies of the submarine reactor. This is the result of the AEC's having been staffed with people who had worked on Admiral Rickover's nuclear submarine program. There could have been other pathways. The Canadian design is in some ways less risky, because its spent fuel is not very desirable for plutonium extraction. The British design is different again. But there was a determined drive by the AEC to adopt the light-water reactor because people in the AEC were to a large degree Rickover's people." In addition, General Electric and Westinghouse were eager to capitalize commercially on their experience in the Navy's reactor program.

Those in the nuclear Establishment held to an underlying faith that the appropriate technological "fixes" would be found for all problems—at the appropriate time. Furthermore, proliferation dangers seemed pretty far away. By the 1960s, the United States was not much worried that its allies in the First World, beyond the French and the British, would seek their own nuclear arsenals. Certainly there was no need to worry that the Russians would be so reckless as to trust *their* potentially unreliable allies in Eastern Europe with nuclear weapons. And it was difficult to imagine in the 1950s and the 1960s that Third World nations would organize themselves sufficiently and acquire the wherewithal and skills to move on to a nuclear weapons capability. That was a severe miscalculation.

After the first Chinese test in 1964, President Johnson, at the instigation of Defense Secretary Robert McNamara, appointed a high-level committee under Roswell Gilpatric to assess the dangers of proliferation and recommend whether or not non-proliferation should be made a top priority of U.S. foreign policy. The preliminary international negotiations for a nuclear non-proliferation treaty (the NPT) had already begun. Johnson was also looking for gestures before the November presidential election that would show that he was "doing good."

One participant recalled what happened: "The committee worked through the fall of 1964 and the beginning of the winter. We had come up with what

looked like a unanimous agreement that proliferation was very dangerous and should be made a very high priority concern. Shortly after Johnson's inauguration in 1965, we had a meeting with Johnson, McNamara, Rusk, and the chairman of the joint chiefs, where we presented our views. Then something very unpleasant happened. One of the most distinguished members of our committee announced that he would not read his part of the briefing papers, but instead would speak ad lib. Instead of speaking for the non-proliferation treaty, he argued that we should arm our NATO allies with nuclear weapons as part of the so-called multilateral force, that this was far more important than the NPT. This weakened the impact of all the other presentations. The impact was then destroyed totally by Dean Rusk, who violently attacked the whole idea of the NPT. He said our conclusions were very dangerous to the security of the United States, and that we should not prepare a written report because it would be leaked. Johnson himself was not very attentive. There was this business where he had a telephone under his desk. He dialed continuously and kept whispering into it. He did this dozens of times while we were talking. Rusk said that our report was unrealistic and unimportant. McNamara tried to defend it, but rather feebly. Johnson then curtly thanked us and ordered us not to write anything and not to discuss it. That was the end of that. Of course, two or three years later he changed his mind." A few crucial years had been lost.

**HOW SAFE ARE SAFEGUARDS?
OR
WHY THE NPT IS ONLY
A MEDIUM YIELD DEVICE**

Finally, in 1968, the United States did reach agreement with the Soviet Union and other states on a non-proliferation treaty. It went into force in 1970. The International Atomic Energy Agency became the "executive" for the NPT. Headquartered in Vienna, the IAEA was founded in 1957 as a result of the drive to find a peaceful atom that would do good around the world. The agency was supposed to promote peaceful uses of atomic energy, but at the same time to apply "safeguards" to prevent the diversion of peaceful developments to military purposes.

Today, the IAEA is a relatively small, efficient body affiliated with, but not subject to, the United Nations. It is one of the last international organizations to have escaped the Third World agitation and

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politicking that has so disrupted the work of most other international organizations, including the UN General Assembly.

The IAEA's safeguard functions expanded with the non-proliferation treaty, and the IAEA is now the cornerstone of what might be called the NPT system.

Lately, there has been some tendency to judge too harshly the NPT system. Hedley Bull, a prominent arms control expert, has pointed out some of its accomplishments: "The NPT has made an important contribution to the control of proliferation by advertising the fact that the spread of nuclear weapons is not inevitable, and so strengthening the hand of anti-nuclear weapons forces in many countries; by enabling countries which wish to remain without nuclear weapons to reassure each other by an exchange of pledges; by contributing to the emergence of détente, especially in Europe; and by the encouragement it has given to the development of International Atomic Energy Agency safeguards. The treaty is not simply the instrument of the nuclear states that are parties to it, but also reflects the desire of many non-nuclear weapons parties to impose limitations on each other."

And an official of the United States Arms Control and Disarmament Agency added: "It's indispensable. We couldn't be where we are without it."

All that is true, but it is also now clear that all that is not enough. Since the technological and economic barriers to proliferation are coming down, the effective potential barriers are political, and the most important is certainly the non-proliferation treaty. Unhappily, it is a product of the First Nuclear Age, and is not very effective in the Second.

The NPT system has a number of notable problems. While the IAEA has been getting stronger all the time, it is still not up to the new pressures thrust upon it. It was fine in a world of relatively few nuclear states, but it will need many more trained people to carry out safeguards in a world with hundreds of reactors, and it is not at all obvious where such people will come from.

One can also read too much into safeguards. The IAEA can evaluate plans for atomic facilities, review records of the movement and use of nuclear materials, and carry out inspection and surveillance of plants—where and when allowed by the host country. It is an accounting system. What this comes down to is a threat, "the deterrence of nuclear materials diversion by detection." But detection can be evaded, and agreements canceled. What would happen if cheating were discovered? IAEA officials have no definite channels for making their findings public. To whom would the information be conveyed? Who

THIS BUSINESS OF REACTORS

There are about 400 nuclear reactors of various kinds, including research reactors capable of producing plutonium, now operating in 49 countries. The main proliferation focus today is on reactors that generate electric power. It is a very big business, with a potential of becoming much bigger. Outside the United States, 112 power reactors operate in 19 countries. Another 342 are under construction, on order, planned, or "faintly planned" in some 41 countries. Within the United States, 60 are operating, 74 are under construction, and 72 are on order. Most of the reactors in the world, whatever their stage of development, are of the "light-water" variety pioneered in the United States.

The price tag is large. A standard sized new reactor and power plant in the United States costs about a billion dollars. Thus, if plans for reactors turn into contracts let, the worldwide reactor business will involve several hundred billions of dollars over the next two decades. A growing list of companies and countries therefore are very eager to carve out their share of the market.

Despite complaints by the American manufacturers, U.S. companies still hold a preponderant position in the industry. By the end of 1974, the United States had provided 56 exported reactors, while foreign companies had exported only 22. In addition, the United States has had a virtual monopoly in the supply of enriched uranium to the noncommunist world, although the Soviet Union is now moving into this business.

would be the policeman? That mysterious and often sluggish creature "world public opinion"? What would be the punishment? Even if the United States and the USSR got together to apply heavy pressure on the violator, would not many nations see this as rather hypocritical—as two nations with tens of thousands of nuclear weapons getting mad at some developing country that only wants two or three little ones?

There is another problem with safeguards: reprocessing large quantities of plutonium for commercial use in a reactor is still a relatively complicated and demanding undertaking. But to reprocess for just a few bombs is a much easier task. The quantities needed are so much smaller. The requisite facility

might require only a dozen people to operate it.

The rationale of safeguards—and here is the critical point—is that the diversion from peaceful use will be discovered well before the violator reaches a nuclear weapons capability, thus exposing him to the risks of international reaction. And yet when a nation has not only reactors and low-enriched uranium but also a stockpile of separated plutonium or facilities for separation, then the value of safeguards—accounting and inspection procedures—is greatly diminished. Even though safeguarded and stockpiled for peaceful future uses, this plutonium is only a short step away from use as an explosive.

“Should the owner decide, for whatever reason, on a sudden move to appropriate the material for illicit purposes,” Victor Gilinsky has said, “the time between diversion of plutonium and complete weapons can be sharply reduced to what might be a matter of weeks, or conceivably days. Under these circumstances, even if it were assumed that IAEA inspection and monitoring systems were improved, it is hard to imagine that an international reaction could be mustered before the assembly of nuclear weapons was completed.”

The second problem with the NPT is that although over a hundred countries have ratified the treaty, China, France, India, Argentina, Brazil, Pakistan, Saudi Arabia, Israel, and Spain have given no indication of signing.

The third problem is the NPT's two-tier structure. Under its definition, there are two kinds of states, nuclear weapon states and non-nuclear weapon states. A country that carried out an explosion before 1967 is officially a nuclear weapon state. This distinction rather freezes the relationships, and has caused non-weapon states to charge “discrimination.” The weapon states do have special rights and privileges and can go on building up their nuclear arsenals. Thus discontent and permanent instability are built into the NPT system.

The fourth problem goes back to the essential issue. The NPT and the IAEA are caught in a contradiction. On the one hand, they aim to prevent the proliferation of nuclear weapons. On the other hand, they are charged with encouraging peaceful nuclear uses. But to repeat, there is only one atom. So the NPT system encourages the diffusion of the *capability* to become a nuclear weapon state swiftly, even while trying to prevent it. Also, a nation can opt out after having benefited from sharing the technology of other members. “I don't think withdrawal would be lightly treated,” said one U.S. official much involved with the NPT. But after all, a country need give only ninety days' notice, and then it can legally quit the NPT.

THAT GERMAN-BRAZILIAN DEAL

In current nuclear lore the German-Brazilian deal ranks in importance with India's explosion. And this particular bargain shows how complex the whole problem of proliferation has become, how many different interests are involved.

On June 27, 1975, it was formally agreed that Brazil would purchase from West Germany an entire nuclear industry, that is, the technology required for the whole fuel cycle. Not only will this be the largest industrial nuclear deal ever, but it is also a huge deal in any terms—worth something over \$8 billion to the Germans. In addition to reactors, Brazil will buy those gateways to becoming a nuclear weapon state: facilities for uranium enrichment and for chemical separation of plutonium. This means that Brazil will have two nuclear weapons options—to enrich uranium to bomb-level concentration, and to separate plutonium from the other wastes.

Rather late in the day, the United States realized what was happening: Germany was selling Brazil the wherewithal to manufacture atomic bombs. At one point, the American firm Bechtel had sought to team up with Westinghouse to offer a similar package, but the U.S. government had forbidden it, for techniques of uranium enrichment and chemical separation are considered too dangerous to export. To make matters worse, Brazil has refused to sign the NPT, and has signaled its interest at different times in acquiring atomic bombs.

Brazil had its own compelling motives for going ahead. The OPEC price hike had hit it very hard, and the Brazilians feared that their growing economy might soon be starved of adequate energy. In addition, there are enough uncertainties about U.S. policy on exporting enriched uranium that the Brazilians wanted to have their own source.

The Germans also had their good reasons to go ahead. They are worried about future sources of raw uranium. In this deal, they will share in putative Brazilian uranium strikes. They also regard American complaints as sour grapes—because an American company did not get the reactor business. The fierce, often mercantilist, economic rivalry to sell nuclear technology can be too easily overlooked. Where profits are the criteria, foreign policy considerations can be shoved to the background. The competition can get very rough. To get the business, the Brazilians made clear, the Germans had to sweeten the deal and do better than Westinghouse—and that meant adding the enrichment and reprocessing facilities that the U.S. government had stricken from the American offer.

The deal is of course of vast economic importance to the Germans, not only in terms of employment, but in providing orders for the troubled German reactor industry. "Wherever we look—in Italy, Spain, Sweden, Thailand, South Korea—the Americans have already been there." So rationalized an executive of the German reactor manufacturer. "The Third World is the only open market left. To fully exploit our nuclear power plant capacity, we have to land at least three contracts a year for delivery abroad. The market here is about saturated and the United States has cornered most of the rest of Europe, so we have to concentrate on the Third World."

The deal may still go ahead in its current form, though a number of major technical problems remain. As one joke has it, "The Germans have sold an enrichment process that does not work, to enrich

Brazilian uranium that does not exist." The financial stability of the main German supplier is also questioned in some quarters. The Carter Administration is putting pressure on the West German government, as is a new anti-nuclear lobby within Germany. But at this stage, the deal is still on. Such things as this make large-scale proliferation seem inevitable, hardly to be stayed or deterred by reasonable fears.

AMERICA'S TWO ATOMS POLICY GOES UP IN SMOKE

The German-Brazilian deal caught the U.S. government mostly unawares. But the Indian explosion a year earlier had already severely shaken American complacency.

Initially several congressmen became alarmed at

A NOT SO IMPOSSIBLE DREAM

On September 14, 1981, 100 kilograms of plutonium are hijacked en route from a plutonium storage area in France to a fuel fabrication plant in Italy. In order not to alarm the public, the French and Italian governments decide to keep the incident a secret while they try to recover the plutonium. On October 20, after more than a month of fruitless search, the other governments of NATO are informed of the theft. They all agree to keep the information secret to avoid public panic.

On December 24, the White House and major newspapers and broadcasting networks receive a letter stating that the World Peace Brigade will explode a nuclear weapon within the next two days. No one has ever heard of the World Peace Brigade.

On Christmas, a nuclear explosion of approximately seven kilotons occurs on the crest of the Blue Ridge Mountains sixty miles west of Washington, D.C. The news spreads quickly around the world. The President appears on national television and explains to the nation all he knows about the circumstances of the blast and the theft of the plutonium in Europe. He tries to calm the public by explaining that no one was killed by the blast.

The next day, a new letter from the World Peace Brigade is received at the White House. It makes the following demands. The United States must immediately renounce all its defense and security agreements. It must pull back all troops and equipment from overseas within six months and immediately stop all sales and shipments of arms. The number of people in the Armed Forces

must be cut to 75,000 within one year. The United States must turn over fifty billion dollars a year to the United Nations to be used in specified Third World countries. A list of acceptable countries is appended to the letter. The President must pardon all black and Spanish-surnamed prisoners in federal institutions within the next three months.

The letter says that nuclear weapons have been hidden in three of the largest cities of the United States and will be exploded if all the demands are not met.

What options do the President and the United States have?

Will we choose to evacuate our largest cities? For how long? Will we choose to ignore the demands of the note?

If the demands of the note are acceded to, what will stop more demands from being made? Won't the government of the United States be permanently under the command of a small unknown group?

At least since biblical days, guerrilla warfare has been a weapon of the few against the many, the weak against the strong. Here we see the logical conclusion, the helplessness of a nation of hundreds of millions of people and millions of weapons against a handful of men. If strategic nuclear warfare between major nations is avoided, nuclear terrorism may be one of the most important political and social problems of the next fifty years.

—adapted from "Nuclear Terror" by David M. Rosenbaum in *International Security*, Winter, 1977

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what was happening abroad—and what was not happening in Washington. “It became very apparent that no one was paying any attention,” said Senator Abraham Ribicoff. “Here was an issue on which the United States and the Soviet Union saw eye to eye, but no one was trying to get them together. Meanwhile, France and West Germany were moving into the nuclear export business in a big way. No one cared very much about the issue in the U.S. government. It was out of sight of the State Department. The Atomic Energy Commission was not paying much attention to this stuff, nor was the Joint Atomic Energy Committee. I have no proof that the nuclear bureaucracy had a vested interest in keeping it quiet, but we certainly weren’t doing anything.”

The State Department and the Arms Control and Disarmament Agency joined the congressmen in taking up the issue.

The most important initiative was Henry Kissinger’s convening of a “Suppliers Club” in London after the Indian test. It was composed of seven possible exporting nations—the United States, Russia, Britain, France, West Germany, Canada, and Japan. The Americans and the Russians were not far apart on the problem. As a Soviet arms controller said recently, “Our interests on proliferation are almost identical with you Americans.” Indeed, a CIA analyst observed, “There is no more sincere antiproliferator than the USSR. One reason is that a number of the countries that might soon become nuclear weapon states are highly antagonistic to the Soviet Union and not too far away from it.”

It was much more difficult for the Americans to work out a common position with the French and Germans, who suspected a plot by U.S. commercial interests to recapture the whole business. “The American case would be better if you still had your virginity,” is the way a German diplomat put it recently. “You’ve had a good time for some years and now you want to be pure.” After all, he might have added, it was the United States that had trained 1100 Indian nuclear scientists and engineers prior to 1974.

Nevertheless, a year ago, the seven supplier nations were able to arrive at a “code of conduct,” an agreement of modest but significant impact. It provides for improved safeguards and agreement not to assist any nuclear explosions, even “peaceful” ones, and for more attention to physical security. “Frankly,” said one ACDA official, “much more has been accomplished than could have been reasonably expected. It is a very useful process.”

Last autumn the French indicated that their stance on proliferation was “parallel” to that of the United States and that they would cooperate with the other

members of the Suppliers Club. “It has required more courage than you can imagine to change our policies,” said an official in the French Foreign Ministry. “We have no domestic political pressure against proliferation, and very strong vested bureaucratic and commercial pressures for exports.” The French have, though, refused to budge on the sale of a plutonium reprocessing plant to Pakistan, despite U.S. pressure. “And Pakistan was a matter of principle. We can go ahead with you in the future. But we can’t go back on deals we’ve already made. Pakistan is the main one. In any event, it is a very small reprocessing plant. Much more important is the German-Brazilian deal.”

The original seven members in the Suppliers Club have now been joined by eight others—Belgium, the Netherlands, Sweden, Italy, East Germany, Czechoslovakia, Poland, and Switzerland—and their secret deliberations continue in London.

U.S. policy, however, has remained schizophrenic. Nuclear power has strong advocates. The core of the now-defunct Atomic Energy Commission resides in the Energy Research and Development Administration and, as one official put it, “There’s a lot of inertia in ERDA.” It took two years before the Ford Administration would admit that U.S. nuclear materials were used for the Indian explosion. Official policy projected 200 new power plants in the United States by 1985—twenty a year—and encouraged exports. President Ford also wanted to invite private industry into the nuclear enrichment business (now a government monopoly), which would only have enlarged the constituency in favor of rapid expansion of the nuclear business.

The 1976 presidential election changed things. During the campaign, Jimmy Carter seemed to be personally involved with the proliferation issue. After all, he had once received a dangerous dose of radiation while helping to deactivate a damaged reactor in Canada. He spoke strongly about the dangers of proliferation, strongly enough to worry Ford. As a secret memorandum warned Ford in September, there was now “considerable sentiment for a forceful nonproliferation initiative domestically.” On October 28, Ford announced a major shift in U.S. policy. He downgraded the emphasis on plutonium reprocessing. He said that future exports would go only to countries that have either signed the NPT or put their entire nuclear energy programs under international safeguards. He also promised that such nations would be guaranteed enriched uranium from the United States. While politics instigated the change, it was really the outcome of a rough struggle between two competing views. The first, representing the attitudes of the old nuclear

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bureaucracy, wanted to continue to push nuclear power development, especially the breeder reactor, which actually produces more plutonium than it consumes. On the other side was the new concern over proliferation, articulated by the Arms Control and Disarmament Agency. The vicissitudes of presidential politics helped to give ACDA a moderate victory.

The October 28 statement represented a substantial turn in U.S. policy, though hardly one of 180 degrees.

WHAT IS TO BE DONE?

"As forces for proliferation are rising, our historical leverage to impose restraints is eroding," warned the secret memorandum that was the basis for the turn-around by the Ford Administration last autumn. Such sentiments point to the crucial question facing the Carter Administration: How much power over proliferation does the United States have in the Second Nuclear Age?

Many argue that it is already too late. "The technology is not all that magical, and we're not a monopoly," William Anders, former chairman of the Nuclear Regulatory Commission, said last year. "The only way to have our way is to be involved, to not opt out, to set the pace, to set the moral tone, if you will." Those who stand to make money from nuclear technology—industry—agree, and are even more outspoken. They argue that the best way we can continue to influence events is by competing aggressively in the marketplace.

This is a distortion. The United States continues to hold dominant power. "We are still *numero uno*," says NRC Commissioner Gilinsky. The United States holds about 70 percent of the nuclear business worldwide. The reactor industries of the other major exporters—France, West Germany, Canada—are all deeply involved with the U.S. industry and technology, and of course these nations are our partners in the Western security system. A United States that put "antiproliferationism" at the top of its agenda would have a profound effect. It is likely that many in the Carter Administration will try to do so.

There is no single solution, of course, but a great number of initiatives can be taken, in addition to those of the last two years, to induce dramatic change and help reduce dangers. (Deftness is also required, especially as the United States does not come to the subject with an unblemished record. "We have to work out a political approach that doesn't set us up as morally superior," says a State Department offi-

cial. "The sledgehammer approach is not the best way of getting others to see the problem the way we do. In fact, it will have exactly the opposite effect of what we want.")

U.S. policy might work toward the following goals:

(1) Improve the nuclear non-proliferation treaty system and strengthen the International Atomic Energy Agency. Today, the safeguards mainly cover reactors; they should be expanded to the entire fuel cycle, the life of facilities, and research institutes, and they should be aimed not merely at "timely detection" but also at prevention of illicit activities.

(2) Provide incentives for nations to eschew a nuclear weapons capability. For instance, other countries must be confident that they can rely *completely* on the United States to deliver a steady supply of slightly enriched uranium—so long as they observe safeguards. It was lack of such confidence, in part, that drove the Brazilians into German arms. The United States should copy the Soviet Union and only "lease" the enriched uranium so that it can control the waste products.

(3) Keep uranium enrichment out of the hands of private enterprise—and thus avoid further economic incentive to export the makings of proliferation. Instead, cooperative international ventures could enrich uranium and handle the waste. This would make national nuclear programs much more visible. People would know what is happening.

(4) Discourage the belief that plutonium should be used in reactors. Evidence increasingly indicates that plutonium recycling may be uneconomic and

HOLD THE MUSHROOMS

John A. Phillips is a Princeton undergraduate, the proprietor of a campus pizza business, who wrote a paper telling how to make an atomic bomb. Working independently, he designed a device similar to one that is still classified by the United States. His bomb could be built for about \$2000. According to the *New York Times*, Phillips has received (and dodged) calls from prospective customers in the French and Pakistani governments. He draws this moral from his work:

"I think I've demonstrated that it doesn't do any good to prevent dissemination of information, because it's already out. The only way to stop proliferation of nuclear weapons now is to restrict the distribution of plutonium and uranium."

impractical, and we should not let people think otherwise. Plutonium separation for power purposes in this country should not go forward. The federal government should, in particular, avoid any commitment to the breeder reactor.

(5) Prevent situations that allow a country to play suppliers off against each other to get the enrichment and reprocessing facilities that are required to make a bomb. One helpful device is the London Suppliers Club, which might give rise to a market-sharing arrangement—as proposed by Senator Ribicoff—that would reduce dangerous competition. Such an arrangement might also help to limit a “gray market,” where suppliers with too much capacity or too much enriched uranium sell secretly at higher prices to countries that want a weapons capability.

(6) Tighten American export rules so that, in effect, the United States *discriminates against* countries that do not cooperate with the NPT system. Up to now, the United States has often seemed to discriminate *in favor* of the recalcitrants. We should no longer make available cheap credits to help spread nuclear power.

There are also a number of other political options.

(1) *The demonstration effect.* By one estimate, the United States has some 30,000 nuclear weapons. In current lingo, the accumulation of nuclear weapons is known as “vertical proliferation.” Some of those most worried about “horizontal proliferation” scoff at the notion that vertical proliferation has any relevance to the problem. But, in the minds of Third World citizens, the connection is real. Why should they be denied nuclear weapons, Third World leaders ask themselves, when the superpowers cheerily go along building up their arsenals? Under the NPT, the superpowers are obligated to reduce their own nuclear arsenals, but this obligation has not exactly been observed. When James Schlesinger was secretary of defense, he talked about creating a “credible response”—that is, suggesting that nuclear weapons are not merely weapons of last resort but also have a rather precise role to play in limited battlefield conditions. This sounded as if the United States was saying that nuclear weapons are after all quite useful tools. If that is true for the United States, the Third World countries say, it is also true for them. A serious effort to control the nuclear arms race between the superpowers would have major meaning for the proliferation problem. As Michael Nacht of Harvard's Program in Science and International Affairs has said, “Progress in SALT will positively affect the perception of some ‘have-nots’ toward the ‘haves’ and should influence the domestic debate in threshold countries in favor of restraint.”

(2) *The prohibition effect.* Prohibit all nuclear explosions, even the “peaceful” underground variety. The United States and the Soviet Union signed a treaty banning tests above a threshold of 150 kilotons in 1974. But this “threshold” is more than *ten times higher* than the strength of the Hiroshima bomb. Unfortunately, the Russians continue to hold to the mistaken belief that “peaceful nuclear explosions” can work wonders, like changing the direction of Siberian rivers, although, increasingly, it seems that such explosions are uneconomic, unbelievably crude for the task at hand, and dangerous. If the United States and the USSR agreed to do away with all peaceful nuclear explosions, it would help to remove the cloak behind which India can disguise its weapons tests.

(3) *The reliability quotient.* Strengthen American security guarantees to our allies. This can greatly inhibit our allies' desire for nuclear weapons, even if it poses unattractive choices for us. For instance, if American troops are withdrawn from South Korea, South Korea is likely to grope for some different kind of security, perhaps a nuclear capability of its own. Then Japan would feel impelled to follow suit; then other nations in Asia.

(4) *The “nuclear free zone” approach.* It is feasible—difficult, but feasible—to contemplate treaty arrangements under which in certain regions nuclear weapons are forbidden.

(5) *The instability factor.* The case can be made that the acquisition of nuclear weapons by countries not now possessing them may invoke dangers that far outweigh any sense of security such weapons may imply. Many West Germans, for example, now realize that an independent German capability would make central Europe more unstable, not less. The same can certainly be said for a number of other countries.

THE DECISIVE STEP?

Yet all these proposals could well prove inadequate. Even if they are all acted upon, we might nevertheless in the 1980s be living in a world glutted with plutonium. “At last we've reached the point where the people making decisions recognize the problem,” observed Professor Irwin Bupp of the Harvard Business School's Energy Research Project, a leading analyst of the nuclear industry. “But they are putting more faith in institutional solutions than is justified. It's unlikely that you're going to be able to prevent further proliferation through international organizations and controls. The inevitable result of spreading nuclear power is a world of abundant

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plutonium, and that means a very high risk of malevolent use."

There is a final, bold step the United States could take—a retreat from nuclear power itself. A number of responsible observers have already called for such action. "We must hold back on a great expansion of nuclear power until the world gets better," said George Kistiakowsky. "It's just too damn risky right now."

When one looks at the decline in orders for new reactors in the United States in 1975 and 1976, one could conclude that such a retreat is already on. But the United States could go further and announce a moratorium on the new development of conventional fission nuclear power. (This would not preclude the continuing of research.) When all the doubts—about economics, safety, nuclear waste disposal, and proliferation—are added up, it becomes reasonable to ask whether fission power, at a billion dollars or so per reactor, is the wisest way to allocate resources for future needs.

An American moratorium could have a powerful demonstration effect, significantly slowing the spread of nuclear energy and thus the spread of nuclear

weapons competence. A moratorium would announce that the world's technological leader, the progenitor of atomic power, had examined it and found it wanting. Then many other countries would surely recalculate their own programs and look in other directions. It is already clear that nuclear energy makes little sense for the Third World. (Several studies now suggest that it is nothing short of ludicrous for a developing country to make the huge capital investment required for nuclear power.) In Western Europe and Japan, as in the United States, nuclear development lags far behind the expectations of only three or four years ago. As in the United States, the delays result from concern about cost, safety, and proliferation.

It is a commonplace that nuclear warfare could extinguish civilized life. Yet that fact today is imbued with new urgency. While there is no one way to stop proliferation, there are many things to be done that could help to manage the Second Nuclear Age. Even in sum, they may not be enough. Yet there is no choice but to try, and swiftly, when the alternative is the terrifying prospect of atomic bombs almost everywhere. □

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