International Task Force on Prevention of Nuclear Terrorism

REPORT: June 25, 1986

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INTERNATIONAL TASK FORCE ON PREVENTION OF NUCLEAR TERRORISM

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REPORT
OF
THE INTERNATIONAL TASK FORCE
ON PREVENTION OF NUCLEAR TERRORISM

June 25, 1986

a project of

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STATEMENT OF THE CO-CHAIRMEN

The Task Force originated with a glimpse into the somber world of those who ponder the possibility of nuclear terrorism. The occasion was an international conference devoted to the subject in Washington in June 1985. The "Conference on International Terrorism: The Nuclear Dimension"* was attended by one hundred and fifty specialists in a wide range of fields that bear on the question of terrorists "going nuclear." They were convened from 13 countries by the Nuclear Control Institute and the Institute for Studies in International Terrorism of the State University of New York, the conference organizers.

For two days, in a variety of ways, we and the other participants addressed the question of whether there was a need, as a conference organizer put it, "not unduly but duly to alarm" policymakers and the public of an impending danger.

By coincidence, at the same time the world was witnessing yet another terrorist attack: a TWA airliner had been hijacked; one of the 145 passengers had been killed; the fate of the others remained uncertain. A U.S. congressional leader, a speaker at the conference, articulated what was on our minds.

"The mightiest military machine in the world is being tied down like Gulliver," said the Congressman. What would happen if tomorrow's Lilliputians had an atomic bomb, or used other means to cause nuclear violence? The world order, not just the country being threatened or harmed, would be at risk.

The conference sought preliminary answers to some difficult and frankly frightening questions: Is it plausible that terrorists will go nuclear? What means could they use and what factors might influence whether they do? How vulnerable are stored and deployed nuclear weapons to theft? If stolen, could they be used? How necessary are civil nuclear fuels that, if stolen, could be fashioned into bombs? How vulnerable are power reactors and other nuclear installations to attack and sabotage? Can the intelligence services detect and counter such threats? What should the superpowers be doing to ensure that terrorists do not precipitate a nuclear war between them? Are there other meaningful international approaches?

The panelists were a selection of senior scientists, government officials, businessmen and analysts of terrorism. We, as presenters of two of the principal papers at the conference, explored with them how terrorists might go about stealing a nuclear weapon, or make one themselves, or precipitate an accident at a nuclear powerplant, or simply pretend they possessed a nuclear device for extortion purposes. Concerns were raised about the possibilities of a black or gray market in nuclear materials and know-how, in technicians willing, for a price, to help terrorists make a weapon. The adequacy of physical protection and safeguards systems was discussed, as was the ability of regional and local governments to manage nuclear emergencies.

The conference, by design, reached no conclusions and made no recommendations. Its purpose was to raise issues to help establish whether a further, more intensive look into the possibility of nuclear terrorism was warranted. In our view, and those of many of the participants, the possibility of terrorists developing the necessary combination of will and ability to engage in nuclear violence, so often portrayed in fiction, seemed, by the issues raised, to be closer to reality. The probability, while still small, seemed to be increasing; the consequences were so potentially catastrophic that extraordinary precautions needed to be taken. Yet, the threat did not appear to be getting all of the attention it deserved among policymakers and the public. A number of the actions that should be pursued to reduce the danger were not being pursued with vigor or at all.

Soon after the conference, Paul Leventhal, President of the Nuclear Control Institute, invited us to be the co-Chair of an International Task Force on Prevention of Nuclear Terrorism. Together with Mr. Leventhal we recruited for the Task Force a number of internationally recognized experts on terrorism, nuclear weapons, arms control, national security, intelligence, civilian nuclear programs, nuclear proliferation, physical protection, nuclear safeguards, crisis management and international law. They came from nine countries, and several had participated in the conference. A number of studies were then commissioned to assist the Task Force in its deliberations.

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* The principal papers and panelists' responses have been assembled in *Nuclear Terrorism: Defining the Threat*, Paul Leventhal and Yonah Alexander, editors, Pergamon-Brassey's, New York, 1986.

The members gathered twice, first for three days in April at the Aspen Institute's eastern retreat on the Chesapeake Bay in Maryland, and for two days at the end of May at the Carnegie Endowment for International Peace in Washington D.C. A wide range of interests and perspectives were openly, and sometimes hotly, debated and applied to the question of nuclear terrorism. Out of these discussions came some significant surprises from among the members: a former designer of nuclear weapons revising his assessment of how easy it would be for terrorists to make a very crude atomic bomb, and some nuclear industrialists revising their estimates of the need for using plutonium, a weapon material, as commercial fuel and of the potential severity of the consequences of a nuclear accident that could be precipitated by terrorists.

The result is the Task Force Report, a consensus document that we submit to the publics of the world and to those in government and industry responsible for their safety and security. We believe its insights into the threat, its analyses of technical and policy issues related to the threat, and its recommendations for action all are important and worthy of serious and intensive consideration. The Task Force worked with a sense of urgency and completed its work one year to the day after the conference. (The report and 26 support studies will soon be published in two volumes.) We believe the question of nuclear terrorism warrants a sense of urgency and that all nations have a part to play in promptly coming to understand the dimensions of the problem and to work to prevent it from materializing.

Bernard J. O'Keefe

Rear Adm. Thomas D. Davies (USN, Ret.)

Washington, D.C.
June 25, 1986

FOREWORD

The International Task Force on Prevention of Nuclear Terrorism was formed in 1985 under the auspices of the Nuclear Control Institute. The Task Force members are senior individuals of varied backgrounds and nationalities, each presenting his or her own views which are not necessarily those of an organization or government with which the member is affiliated. The Task Force members hold varied and sometimes opposing views on public policy matters, but they are bound by the common objective of reducing the risk of nuclear terrorism.

This report is a consensus document. All members do not necessarily agree on every point and all wordings, but in each case a substantial majority of members do agree. In a few instances individual views are noted in the text or a footnote. The members believe that this document as a whole can make a substantial contribution to public understanding of the issues, and be of value to those in government and industry responsible for the safety, security and other policy matters covered in the report. The recommendations are intended to be generally applicable, although because of the variety of political, social and industrial systems among nations, not all of the recommendations can be applied universally.

The Task Force on Prevention of International Terrorism is a project of the Nuclear Control Institute, co-sponsored by the Institute for Studies in International Terrorism of the State University of New York. The Nuclear Control Institute is a non-profit, non-partisan, national educational organization formed in 1981 to increase understanding of problems of nuclear proliferation. The State University of New York Institute for Studies in International Terrorism was organized in 1976 to provide opportunities for study and research in the understanding of international terrorism.

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THE TASK FORCE REPORT

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DEFINING THE THREAT

1. At the beginning of the fifth decade of the nuclear age, three overriding imperatives dominate mankind's efforts to exploit and control the energy of the atom:

— prevention of nuclear war between the superpowers;
— prevention of the further spread of nuclear weapons;
— prevention of catastrophic nuclear accidents.

Now there is a fourth imperative: prevention of nuclear terrorism—nuclear violence by subnational groups—which should be seen as having an important bearing on the other three. The public has given little serious attention to the possibility of nuclear terrorism, while policymakers devote considerably more attention and resources to the other three imperatives. Yet, the fact that so far there has been no serious act of nuclear terrorism is no reason for complacency.

2. Terrorists could "go nuclear" in a variety of ways. The most important of these are stealing a bomb, stealing nuclear materials suitable for weapons and building a bomb with these materials, sabotaging or holding for ransom a reactor or other nuclear facility or a shipment of reactor fuel or waste, or by credibly claiming to have acquired a weapon or nuclear material for building a bomb or a dispersal device. Each of these would constitute a form of nuclear violence, actual or threatened, against society.

3. Terrorists might be more willing than nations to use acquired nuclear weapons. Deterrence may not work against terrorists who go to the lengths of "going nuclear." In this sense, nuclear terrorism could be the most dangerous variant of nuclear proliferation and non-nuclear terrorism. While the probability of nuclear terrorism remains low, the consequences for urban and industrial societies could be catastrophic. An explosion would breach the critical post-war moratorium on use of nuclear weapons; in a worst-case situation it conceivably could spark an inadvertent nuclear exchange between the superpowers. Thus, the potential for nuclear terrorism poses an exceptional global danger.

4. In the judgment of the Task Force the probability of nuclear terrorism is increasing. This is due to a confluence of factors:

— the growing incidence, sophistication and lethality of conventional forms of terrorism, often to increase shock value;
— apparent evidence of state support, even sponsorship, of terrorist groups;
— the storing and deploying of nuclear weapons in areas of intense terrorist activity;
— an increasing number of potential targets in civil nuclear programs—in particular facilities and shipments in which plutonium and uranium, in forms suitable for use in weapons, are present;
— potential black and gray markets in nuclear equipment and materials.

5. While as yet there are no public signs that any terrorists have the essential combination of capability and will to engage in an act of nuclear violence, the psychological and political impact of a successful terrorist nuclear threat might well be exceptional. A plausible threat or hoax involving a nuclear device or sabotage could have enormous coercive and disruptive results without mass killing or destruction; indeed, we believe this may be the most likely form of nuclear terrorism at this time.

6. Given the widespread deployment of tactical nuclear weapons, the continuing spread of weapon-usable forms of nuclear materials, and the availability of know-how applicable to assembling fission weapons, the interest of terrorists and, as the case may be, their sponsors in acquiring nuclear weapons should be regarded as technically, politically and psychologically plausible. There have been publishe
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Background

The Task Force notes that the size and destructive power of the nuclear arsenals of the United

significant amounts of radioactivity, is by no means implausible and is technically feasible.

8. The Task Force recognizes there is an element of risk in drawing public attention to the possible means of nuclear terrorism, but we consider the far greater risk to be in leaving basic concerns unspoken and needed improvements undone. Opportunities for nuclear terrorism are likely to be known to sophisticated terrorist organizations and to their state sponsors. The public should understand the nature of the threat. It will then be in a position to decide on protective steps we believe should be taken promptly and the more difficult institutional improvements and international arrangements we believe should be pursued over the long term. The near-term improvements are feasible and not overly expensive at least when viewed in national-security terms.

9. If governments take additional measures now, they may prevent nuclear terrorism before it materializes and will be ready to respond in the event it materializes. The role of the media in providing accurate information and dispelling undue fears during the course of a nuclear-terrorist incident is especially crucial. The Task Force report and supporting documents are intended to increase public understanding of the risks of and the possible countermeasures against nuclear terrorism without providing sensitive details that could prove useful to would-be perpetrators.

10. The Task Force, for example, has determined that building a crude nuclear device, although more difficult than previously suggested by some experts, is within reach of terrorists having sufficient resources to recruit a team of three or four technically qualified specialists. The team need not have previous experience in building weapons, but would need chemical high explosives and a sufficient quantity of weapon-usable nuclear material, most probably in metallic form. A special study prepared for the Task Force by a team of former U.S. weapons designers has established that crude nuclear bombmaking, while not as simple as once supposed, can be accomplished with a sufficient quantity of reactor-grade plutonium (the kind separated by industry in some countries from the spent fuel of a power reactor) or highly enriched uranium (the kind used to fuel many research reactors) in metallic or possibly even in oxide form. Previously, some analysts of this problem believed that a group gaining entry to a civil nuclear fuel fabrication plant could fashion a crude bomb on site simply by wrapping some high explosive around a "coffee can" container of a few kilograms of plutonium oxide powder and then detonate the contraption to obtain a nuclear yield equivalent to hundreds, even thousands, of tons of TNT. The study found that such a "coffee-can bomb" is not feasible, although use of oxide in a crude nuclear device is possible in a substantially larger amount—at least many tens of kilograms. This information is essential to devising precautions, restraints and controls that are adequate to ensure that terrorists do not acquire significant quantities of weapon-usable nuclear materials.

11. At the same time, the Task Force has concluded that nuclear terrorism is a threat requiring, in addition to technical strategies, an array of political and legal approaches that should be pursued with due recognition of established international norms. Several approaches explored by the Task Force are intended to reduce the threat or to cope with the consequences directly—such as those dealing with physical protection, intelligence, and emergency management. Other approaches are deemed by a number of the Task Force members to be of more limited utility but nevertheless useful by addressing the threat indirectly and thereby influencing the climate conducive to nuclear terrorism. Some of the Task Force members assign essential importance to these other approaches: strengthening international law, addressing underlying causes of terrorism, and pursuing arms control.

12. The Task Force agrees that in order to uphold the international consensus needed for the fight against nuclear terrorism, nations should adhere rigorously to their own obligations under international law as they rightly condemn terrorists for their violations of international law.

13. It is beyond the mandate of the Task Force to explore in depth the causes of terrorism generally, including possible nuclear terrorism. We recognize, however, that terrorism often thrives in an environment where prevailing political, economic and social conditions create anger and despair among social, ethnic, religious or national populations. These conditions serve as a source of popular support for terrorist causes and of fresh recruitment for terrorist groups. Obviously, addressing grievances will not affect the dedication and resolve of the most radical terrorists whose objective is to destroy the prevailing order. On the other hand, we believe it necessary for governments to address underlying political, economic and social conditions to the extent possible. This might help dry up fertile ground for terrorists and thereby deprive them of popular support and their recruitment base. There is little prospect

The Task Force report and supporting documents are intended to increase public understanding of the risks of and the possible countermeasures against nuclear terrorism without providing sensitive details that could prove useful to would-be perpetrators.

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of ending terrorism in the short term. Several forms of nuclear terrorism, however, pose demanding tasks to terrorist groups which could be helped greatly by a broad support base. Thus, the denial of this base is important for containing the threat of nuclear terrorism in the long term.

14. All nations, in striving to deny terrorists nuclear arms, should pursue arms-control efforts to help limit the growth and the spread of nuclear arsenals. Our recommendations on a number of relevant arms control measures will be found further in the report.

15. Finally, the Task Force emphasizes that much can be done to reduce the dangers; the current situation does not call for hopelessness or despair. Nuclear terrorism is possible, but not necessarily imminent or inevitable. There is, in fact, some basis for optimism. Obstacles to nuclear terrorism exist, and these no doubt help to explain why no terrorists, either operating independently or with state backing, are known to have attempted major acts of nuclear violence. The disincentives for engaging in such heinous acts are still high. In a number of nations, we find that protection of the civil and military nuclear sectors has been improved in recent years. We also find that the push to plutonium fuel in power programs has not proceeded as quickly as projected only a few years ago. Widespread commercial trade in plutonium would require improved controls against terrorism. Due to the adverse economics of using plutonium as an energy source over the next several decades, there is a window of opportunity to develop improved controls against nuclear terrorism if commercial uses are deferred until then. In the meantime, weapon-usable forms of uranium are beginning to be phased out of civilian research reactors, especially on university campuses where such fuel is most vulnerable. Certain paths to bombmaking, particularly the seizing and reprocessing of spent fuel, are more difficult and dangerous than popularly supposed. Indeed, sabotage of properly casked spent-fuel shipments is likely to pose little risk except to the perpetrators. Nuclear powerplants are designed to resist rocket attack from afar and to shut down safely if powerlines to or from the plant are cut. And the risk that nuclear terrorists could trigger inadvertent nuclear war is being reduced substantially by ongoing diplomatic and technical cooperation between the superpowers. The challenge is for governments and industry to build on the foundation of these technical, organizational and political strengths to more effectively counter the threat of nuclear terrorism. Effective measures are available and should be taken to minimize risks of nuclear terrorism without jeopardizing development of nuclear energy for peaceful purposes.

[Task Force member Inga Thorsson wishes to add the following personal view: No serious discussion of the threat of nuclear terrorism can disregard the most decisive threat to our survival: the existence of nuclear weapons. The threat of nuclear terrorism is due to this fundamental fact and to the production of electrical power by nuclear reactors. Consequently, and aware as I am that knowledge of evil—in this case, the splitting of the atom—can never be taken away from mankind, the political renunciation of nuclear weapons and nuclear-produced electric power is a prerequisite to removal of the nuclear terrorist threat. In the final analysis, all states possessing nuclear weapons are nuclear terrorists, keeping the peoples of the world hostages to their political aims, to be achieved, if necessary, by the use or the threat of use of nuclear weapons.]

ESTABLISHING PRIORITIES

The Task Force has established an order of priorities as a guide to policymakers and the public for countering the threat of nuclear terrorism. It is based on three basic considerations: the gravity of the consequences, the vulnerability of potential targets and the nature of the adversary.

I. Gravity of the Consequences

1. Theft and explosion of a nuclear weapon would likely have the most catastrophic consequences; indeed, the theft and threat of use in and of itself could have severe political and psychological consequences. Accordingly, the highest priority should be given to protecting nuclear weapons against theft, preventing the detonation of nuclear weapons in the event they are stolen, and recovering stolen weapons. Improvements are needed in all three areas, as detailed later in the report.

2. Theft of nuclear materials and their use or threatened use in a crude, homemade bomb—or, with help from a state, in a more sophisticated device—is the second most dangerous possibility. Interest in protecting civil and military nuclear materials from theft, and, at least for the time being, in minimizing production and use of materials in weapon-usable form, should be correspondingly high.

3. Sabotage or threatened sabotage of a reactor, fuel facility or fuel shipment is the third most dangerous possibility. A nuclear explosion resulting from such sabotage is all but excluded, but potential contamination to the surrounding area could be severe, depending on weather conditions at the time, on the ability of terrorists to deactivate or circumvent fall-back safety mechanisms, and on the ability of building structures and shipping containers successfully to withstand the consequences and to prevent dispersal of radioactive materials.

II. Relative Vulnerability

1. In general, civil nuclear installations and shipments worldwide have been more vulnerable than those in the military sector of countries where nuclear weapons are produced, stored and deployed. However, there may well be exceptions. Limited resources and the more severe social and legal constraints in the private sector of democratic states result in the guard forces, barriers, exclusion zones and equipment being generally of a lesser order than those used to protect weapons and military installations and shipments. In particular, civil nuclear materials suitable for use in nuclear weapons are not necessarily given the same level of protection worldwide as is accorded to weapon materials and to weapons themselves.

2. The nuclear-weapons sector is generally the less vulnerable worldwide, given the substantial resources already applied to protective measures. Yet, political and budgetary factors serve unduly to inhibit the upgrading of protective measures needed to counter the terrorist threat against potential military nuclear targets. In particular, upgrading the protection of nuclear weapons deployed in Europe and in the Pacific region, especially in countries where terrorism is intense, is not proceeding as rapidly as feasible, and military production reactors in the United States do not have the costly containment structures required for commercial nuclear powerplants.

III. Nature of the Adversary

1. Mass hysteria and social disruption arising from a credible nuclear threat or hoax, rather than mass killing and destruction resulting from a nuclear detonation or sabotage, may be the objective of a group attempting nuclear terrorism. Indeed, most terrorists operating within their own borders would be inhibited from engaging in actual nuclear violence out of fear of losing popular support for their cause. However, a single successful theft of a weapon or of weapon-usable material or a successful penetration of a nuclear-weapons site or a nuclear reactor would cause severe social, psychological and political disruption—an objective common to most terrorists.

2. The growth of terrorism across borders poses a special problem because the perpetrators may not be inhibited from committing nuclear violence against foreign populations. The self-image of some terrorists as being at war with a superpower or a military alliance could create incentives for a "counterforce" nuclear strike against military installations in which civilian casualties would be regarded as a deplorable but unavoidable "collateral damage." For example, a number of NATO installations are far enough from population centers to permit a terrorist nuclear strike with a low-yield device with relatively few civilian casualties.

The highest priority should be given to protecting nuclear weapons against theft, preventing the detonation of nuclear weapons in the event they are stolen, and recovering stolen weapons. Improvements are needed in all three areas.

Acts of nuclear sabotage and theft and the technical resources needed for construction of a crude nuclear device are within reach of modern terrorist organizations with sufficient resources. Nuclear terrorism, although it may appear improbable, should not be discounted or dismissed. It should be seen as a real threat to civilization.

3. A further consideration is whether terrorists operating across borders are operating independently or with state support. One view among experts is that the latter are likely to have a greater capability and fewer inhibitions. U.S. Secretary of State George Shultz, in a recent speech to the National Defense University, declared that "state support will probably be the single most important factor in enabling terrorists to acquire [advanced] weapons, which may well include nuclear devices . . . " But some analysts regard the vulnerability of states to retaliation as a major deterrent to state sponsorship of nuclear terrorism and regard all but perhaps the most fanatical regimes as likely to be so inhibited.

4. A terrorist group's place in the political spectrum is sometimes seen as being significant in assessing its potential for nuclear violence. Some observers maintain that terrorists of the "left" tend to regard their cause as designed to better the human condition and thus generally avoid mass casualties, while terrorists of the "right" tend to be more contemptuous of the masses and are more prone to acts that take relatively large numbers of lives. However, there is an increasing pattern of random killing among terrorists of all political persuasions that that tends to invalidate this distinction.

5. Paradoxically, some analysts believe that if counter-terrorism efforts prove generally successful, these efforts could contribute to the risk of nuclear terrorism. A heightened "war" against terrorism might lead to an escalation of terrorist violence. According to this view, terrorists often see themselves "on the defensive," a self-fulfilling image that is confirmed by ever harsher responses to their violent acts. It is also regarded as conceivable that a terrorist group, finding itself in a deadlock situation, blocked in its efforts and no longer able to capture headlines, and believing that its very existence is threatened, could resort to nuclear terrorism on the basis of having "nothing to lose" and needing a "terrorism spectacular" to regain its prominence.

6. The final consideration is whether terrorists are likely to have the combination of motivation and capability needed to engage in nuclear violence. There are a number of options for escalating violence before they approach a nuclear threshold. Nuclear systems are but one among the high-technology options available to terrorists. Chemical and biological systems, for example, offer terrorists effective methods of threatening to kill or actually killing large numbers of people. Further, it is difficult to think of a demand that could be used to justify an act of nuclear violence. For these reasons, some analysts discount the possibility of nuclear terrorism or forecast an increasing number of highly plausible nuclear hoaxes. At the same time, as noted above, acts of nuclear sabotage and theft and the technical resources needed for construction of a crude nuclear device are within reach of modern terrorist groups with sufficient resources. Nuclear terrorism, although it may appear improbable, should not be discounted or dismissed. It should be seen as a real threat to civilization.

TASK FORCE RECOMMENDATIONS

The Task Force recommendations provided below were developed on the basis of a number of background position papers as well as on the basis of discussions—some of them quite spirited—at the Task Force meetings, followed by long-distance written and verbal comments*. Many of the subjects discussed are complex in nature. The recommendations are presented in the hope they will provide a basis for further consideration by policymakers and the public and for action by responsible authorities.

We offer two types of recommendations: steps that should be taken promptly to eliminate vulnerabilities and to improve responses to nuclear terrorism, and more complex institutional and international efforts that should be pursued over the long term to reduce risks . Our recommendations follow:

SHORT-TERM RECOMMENDATIONS

I. Protecting Nuclear Weapons**

1. ***Nuclear-weapon states should determine whether their weapons are sufficiently protected to deter or repel terrorists.***

The Task Force, in response to the possibility of the terrorist threat, recommends that all nuclear-weapon states provide comprehensive protection of deployed and stored nuclear weapons, based on a multi-layered system of defense-in-depth. Responsible officials should determine promptly whether protective measures meet the following baseline objectives:

— Protective devices and materials should be integrated into the weapons themselves, specifically "permissive action link" (PAL) systems with "limited try" and "command disable" features that render stolen weapons useless, in addition to "insensitive high explosive" and "one-point safe" characteristics that make a weapon resistant to malevolent or accidental detonation;

— Command, control and communications systems for deployment and use of nuclear weapons should be sufficient to deny terrorists or other unauthorized individuals access to essential data on detonating a weapon should they acquire one;

— Weapon-protection systems should be designed to deter, where they cannot preclude, terrorist activities directed at nuclear weapons;

— Protection systems should facilitate recovery of stolen weapons by a variety of means including agreements among all concerned parties for "hot pursuit" across borders, and sharing of the U.S. Nuclear Emergency Search Team (NEST).

2. ***All tactical nuclear weapons should be fitted with the most advanced self-protecting systems.***

The most advanced PAL and command-disable systems should be used to provide the fullest possible protection against terrorists detonating a stolen weapon or dismantling it to obtain nuclear material. Forward land-based nuclear weapons in NATO, naval tactical nuclear weapons, and tactical nuclear

Command, control and communications systems for deployment and use of nuclear weapons should be sufficient to deny terrorists or other unauthorized individuals access to essential data on detonating a weapon should they acquire one.

* The Task Force notes that the background papers, commissioned by the Nuclear Control Institute to assist the Task Force in its deliberations, provide a valuable source of information and perspective. They soon will appear in published form with the Task Force report.

** A few members of the Task Force wish to note that the following recommendations should not imply their endorsement of the production and deployment of nuclear weapons. In their view, nuclear terrorism could be better dealt with in the complete absence of nuclear weapons. They are supportive of general and complete disarmament and more particularly nuclear disarmament.

U.S. Navy weapons, mostly large missiles on submarines, but also many tactical weapons, do not have PALs, at least on board ship . . . . Navy tactical weapons are vulnerable to use by terrorists if successfully seized . . . . A further concern is that a number of tactical weapons stored in the U.S. do not have PALs.

weapons stored in the U.S. should be modified promptly in that order of priority. These improvements should not be subordinated to political issues within NATO and the U.S. military services: NATO and service programs should be adjusted to give priority to the necessary modifications. In addition, U.S. PAL technology should be shared prudently with other nations possessing nuclear weapons to protect against unauthorized use by military personnel or terrorists.

3. ***The U.S. Nuclear Emergency Search Team should be upgraded.***

NEST, operated by the U.S. Department of Energy, should be improved and expanded. Ways of building electronic tracking devices into nuclear weapons without creating new vulnerabilities, as well as putting similar features into containers for storage or shipment of weapons or weapon materials, should be seriously investigated because NEST would face a virtually impossible task if it had to find a nuclear weapon or container once shielded and concealed within a city. Nations with nuclear weapons deployed within their borders should develop their own national NESTs if they do not have them already. Establishment of an international NEST, authorized to request assistance in the form of technical resources of the nuclear-weapon states, should be considered seriously.

Background

U.S. nuclear weapons in Europe, now reduced to about 4,800, as well as those deployed in some areas of the Pacific, are considered the most vulnerable to attack by rocket or mortar, or to theft, by terrorist groups. These weapons constitute a set of potential targets in areas where terrorists, usually with a strident anti-Americanism as an element of their perspective, have operated or are operating.

Multi-layered programs for protecting these weapons were intensified after the terrorist attack on the Israeli athletes at the 1972 Munich Olympics. The system now includes a series of security barriers—physical, technical and human—which are being upgraded continuously as funds become available and as political constraints of the NATO alliance allow.

The most significant development has been expanded use of the Permissive Action Link (PAL), a locking system to prevent unauthorized use, on European-based weapons. There is a variety of PAL devices, from old-fashioned combination locks to electronic devices integrated into the circuitry of a weapon. The most recent PAL devices, together with command-disable systems which can disrupt the firing circuits of a weapon, make it virtually impossible for a terrorist group to detonate a stolen weapon that has these design features. In addition, an "insensitive" chemical explosive and "one-point safe" design characteristics make such weapons resistant to accidental and unauthorized detonation. They have been introduced in the past few years and are being incorporated into replacement weapons. The deployment to Europe of such replacement weapons should be expedited to overcome deficiencies.

Some factors work against improving the security of the weapons. Security always has to be balanced against the operational responsiveness of the weapon. Also, increasing the security of a weapon is regarded as expensive within NATO where the question of cost-sharing is an intensely political one. Obtaining common NATO funding for upgrading the security of U.S. weapons in NATO countries can be a slow process, and the U.S. Congress is basically opposed to "pre-financing"—that is, appropriating funds for a project eligible for common funding by NATO. The new U.S. budget-deficit reduction law (Gramm-Rudman) may make Congressional funding even harder to come by.

U.S. Navy weapons, mostly large missiles on submarines, but also many tactical weapons, do not have PALs, at least on board ship. The absence of PALs is justified by the Navy on the basis of a complex launch system designed to prevent unauthorized use that can involve as many as 30 individuals, each charged with separate actions. Nevertheless, Navy tactical weapons are vulnerable to use by terrorists if successfully seized. PAL systems on tactical weapons would increase security of nuclear weapons on ships making visits to foreign ports, especially in regions of high terrorist activity. A further concern is that a number of tactical weapons stored in the U.S. do not have PALs.

The Nuclear Emergency Search Team (NEST), assigned to find and render harmless stolen nuclear weapons or improvised nuclear devices, is operated out of a U.S. national laboratory with smaller units near Washington and in Europe. During its 11 years of existence, NEST has responded to close to 100 threats, none of which proved to be genuine.

NEST is an efficient unit for finding stolen or improvised nuclear weapons if the approximate location of the bomb is known. However, NEST is small and has a limited capability for finding well-shielded sources of radiation. In a large urban area, for example, it would be next to impossible to locate such a device within a limited period of time unless the general vicinity of its concealment were known. NEST's limited technical capability is further reason to upgrade protection of weapons and of materials usable in weapons to make theft all but impossible.

An event much less significant than the detonation of a weapon—such as the seizure or attempted seizure of a weapon or the penetration of a storage site—is likely to be regarded as a terrorist "success." It is important, therefore, to deter to the maximum extent possible terrorist activities directed at nuclear weapons.

II. Protecting Nuclear Materials

1. ***Civil nuclear materials worldwide in forms suitable for use in weapons should be given protection equivalent to government protection of weapons.***

In view of the terrorist threat, the Task Force recommends that certain forms of uranium and plutonium, because they are usable in nuclear weapons, should be provided the equivalent level of protection in the private sector worldwide as governments provide where nuclear-weapon materials, weapon components and the weapons themselves are located. There should be no less vigilance and protection on the grounds that these nuclear materials are dedicated for peaceful purposes.

2. ***The cost of protecting weapon-usable forms of nuclear materials should be factored into private decisions to produce and use them.***

The costs of providing such protection over weapon-usable forms of nuclear materials in peaceful programs should be considered by those who produce and use these materials, and by their governments as well. These costs should be weighed against the benefit of proceeding with commercial use of these materials for the purpose of extending supplies of nuclear fuel and promoting long-term energy security.

3. ***In the meantime, reexamination of civil applications of plutonium can be conducted on economic grounds.***

Widespread commercial use of plutonium should be subject to reexamination on economic grounds, including the security costs mentioned above. Such a reexamination would now be most appropriate since reserves of non-weapon-usable nuclear fuels are high and readily available at low prices; in addition, technology for highly efficient production and consumption of these fuels is becoming available. Sufficient supplies of low-price uranium fuel could permit storage or disposal of spent fuel without reprocessing—the so-called "once-through" fuel cycle—although any local opposition to such storage or disposal would have to be addressed. There should be consideration of whether civil use of plutonium can be limited to research, development and demonstration of the breeder reactor as a long-term energy option. This would leave open national options for eventual commercial development of this and other plutonium-fueled reactors, as economic and security conditions allow.

4. ***Conversion of reactors from weapon-grade uranium fuels to lower-enriched uranium not usable in weapons should be considered at this time, as well.***

Virtually all research and power reactors utilizing highly enriched uranium fuels can be converted to low-enriched fuels now available. Consideration should be given worldwide to their prompt conversion, in light of the terrorist threat, as was recently required for most licensed research reactors in the United States.

5. ***To the extent civil materials suitable for weapons are used, extraordinary precautions should be taken to protect them from terrorists.***

Facilities producing or handling metallic and other forms of weapon-usable uranium and plutonium are of special significance because these materials are suitable for a crude bomb. It is important, therefore, that "in-depth" protection be provided. Shipments of significant quantities of these materials over land are especially vulnerable and, accordingly, escorts or guards should accompany each shipment in special vehicles. Shipments on the high seas should take place under constant surveillance by escorts and under

In a large urban area, it would be next to impossible to locate a [nuclear] device within a limited period of time unless the general vicinity of its concealment were known.

Plans for reprocessing and for commercial use of the recovered plutonium over the near term raise issues of international plutonium trade and concomitant proliferation and terrorism risks that seem unjustified by present economic benefits.

conditions that assure close communication with appropriate forces. (Recommendations for protecting fuel facilities and reactors containing potentially explosive forms of plutonium and uranium are contained in the next section.)

Background

National sovereignty over nuclear and other domestic energy strategies is a rightfully cherished principle among nations. Long-term energy security is an essential objective of all nations. Nations lacking large domestic energy resources have little choice but to regard the energy contained in nuclear wastes as a potential resource too valuable to "throw away," at least until they are certain of other resources to take its place. Until such alternatives are as assured as the "domestic resource" represented by the plutonium and uranium content of their spent fuel, these nations cannot be expected to give up their long-term option to reprocess the waste and to recycle the recovered fuel into their power reactors. There is some question, however, as to whether a short-term imperative exists for nations to make large-scale commercial use of plutonium fuel at a time when the risks of terrorism run high.

[The Japanese members of the Task Force wish to add the following: Whatever may be the general applicability of the recommendations and the discussion contained in this section, the unique situation in Japan warrants continuation of the national program to make use of plutonium as reactor fuel. Japan is without indigenous energy resources and consequently there is a national plan to recover plutonium and uranium from spent reactor fuel. Japan is convinced that the utilization of plutonium as reactor fuel soon after the reprocessing of spent fuel will contribute to the prevention of nuclear proliferation and nuclear terrorism. Extensive high-technology measures have been developed to protect Japanese plutonium and highly enriched uranium. This work will continue, and there should be a sharing of such information among nations. Japanese society, because of its tragic experience with nuclear weapons, would not tolerate anything but the most elaborate precautions to guarantee that peaceful nuclear materials in Japan are never used in weapons.]

There are viable alternatives to a plutonium market including greater reliance on uranium fuel not usable in weapons, as well as possible utilization of thorium in nuclear fuel. Under prevailing conditions, reprocessing of spent fuel and fabrication of the recovered plutonium and uranium into fuel for recycle in conventional light water reactors appear not to be economically competitive with the once-through fuel cycle. Massive new finds of uranium have produced cheap and plentiful supplies that, in combination with cheaper oil and coal and a lower-than-expected growth rate of nuclear power, have resulted in lower uranium demand and no likely early need for large quantities of plutonium or for the plutonium-fueled breeder reactor. Thus, plans for reprocessing and for commercial use of the recovered plutonium over the near term raise issues of international plutonium trade and concomitant proliferation and terrorism risks that seem unjustified by present economic benefits.

About 45 tons of plutonium are being discharged each year as waste in the spent fuel of commercial nuclear power plants; by the year 2000 a total of 1,400 tons of plutonium will have been produced in spent fuel. In some countries, reprocessing is underway or planned to recover plutonium and depleted uranium for the stated purpose of recycling as fuel in existing powerplants and eventually in breeder reactors. If present reprocessing plans are carried out, by the mid- to late 1990s the amount of plutonium separated for civil uses worldwide will exceed the 200 tons separated by the superpowers for use in nuclear weapons. Tons of plutonium will be in commercial transit, posing increased opportunities for theft and diversion by terrorists.

The transport of weapon-usable nuclear materials on the open road poses the biggest risk of theft. In the United States, plutonium is not used in the commercial power program; significant quantities of plutonium and HEU used in the Energy Department's research and development program are generally transported over highways in a weapons-carrier, the Safe Secure Transport (SST), which is regarded as virtually impenetrable and theft-proof. However, armed-convoyed transport of nuclear-weapon materials between buildings within a government installation is done in less secure "bread-van"-type vehicles, which could be vulnerable, for example, to "snatch" attacks by helicopter. Transport of civil plutonium and highly enriched uranium in other countries is generally done in armored vehicles, some of which are equivalent to the SST and some of which are not.

The IAEA's role in physical protection of nuclear materials has been strictly advisory because

protection against theft always has been a national prerogative. Some international safeguards procedures, such as the use of tamper-indicating seals and remotely operated cameras to provide containment and surveillance of nuclear materials, offer some physical-protection benefit. But the best of these measures, fiber-optic seals and near real-time satellite surveillance, are often regarded as intrusions of national sovereignty. National physical protection systems vary in quality from country to country—the IAEA's minimum guidelines notwithstanding—and they rarely rise to the level of protection provided by governments over nuclear weapons and weapon materials.

The IAEA EURATOM safeguards system, generally regarded as adequate to keep track of fabricated nuclear fuel elements, has more difficulty in accounting for nuclear materials in bulk form. The safeguards system is designed to provide "timely detection" of diversions of significant amounts of nuclear materials and to deter such diversions by the risk of detection. A nation may well be deterred from attempting to divert bomb quantities to a secret weapons stockpile on the assumption that the IAEA will detect and report the diversions before the materials can be converted into weapons. Terrorists, with insider support, might be able to divert small amounts from certain types of bulk-handling plants before the IAEA or the state can detect the loss. The stolen material could be enough at least to substantiate a credible threat. National safeguards systems are limited in their ability to detect such small diversions in time.

An attractive alternative to reprocessing for at least some countries may be to store the spent fuel or dispose of it without reprocessing, especially if the supplier or another country agrees to take the spent fuel off its hands. Such an approach would avoid the economic and political costs of providing a domestic means for waste disposal and would support the non-proliferation regime.

These efforts do not necessarily involve cancelling development of reprocessing and breeder technology as a hedge against future energy shortages; rather, these efforts would serve to allow postponement of widespread commercial production and use of plutonium fuels until such time as their need is clearly established, the threat of terrorism has lessened, and the adequacy of safeguards and physical-protection systems has improved. Similiarly, there are now opportunities to accelerate conversion of research reactors from high-enriched to low-enriched uranium fuels and thereby eliminate access by terrorists to another potentially vulnerable weapons-usable nuclear material. A recent regulation requiring conversion of most licensed research reactors in the United States can serve as model for other nations.

There are now opportunities to accelerate conversion of research reactors from high-enriched to low-enriched uranium fuels and thereby eliminate access by terrorists to another potentially vulnerable weapons-usable nuclear material.

III. Protecting Nuclear Facilities

1. ***Denial of access to nuclear facilities should be the basic consideration in protecting against sabotage.***

Because of the extensive damage terrorists could do once they gain entry to a nuclear installation, denial of access should be the *sine qua non* of protection against nuclear terrorism. Even if a response force arrives only a few minutes after terrorists gain entry, it could be too late to prevent sabotage with severe consequences.

2. ***Thorough vigilance against the insider threat is needed.***

Security staffs at nuclear facilities should be alert to the crucial role insiders can play in overcoming defenses against terrorists. Access to vital areas of facilities should be restricted to the extent possible without compromising safety—that is, without inhibiting access to such areas during an emergency. The reliability of employees at nuclear facilities should be a matter of prime concern, although security measures against the insider threat will necessarily vary according to the laws and traditions of individual nations. Rigorous assessments of potential employees by such means as psychological screening and background checks, and regular monitoring of employees' reliability, should be carried out according to professional standards with due regard to rights of privacy and free expression.

3. ***Guard forces should be thoroughly trained and authorized to use deadly force.***

Guard forces and nearby reserve forces should be provided with high-quality and frequently updated training against the terrorist threat. They should be advised as to the appropriate use of deadly force to ensure responses sufficient to prevent a large sophisticated group of attackers or a few infiltrators from

Because a number of insiders and a team of outsiders can be instrumental in assuring the success of diversion or theft of materials or sabotage of a facility by terrorists, the threat against which physical protection systems are designed should be reevaluated and upgraded when circumstances warrant.

gaining entry to nuclear facilities.

4. ***The basis used for designing physical protection of nuclear plants should be reviewed to ensure that it accurately reflects the current threat.***

Because a number of insiders and a team of outsiders can be instrumental in assuring the success of diversion or theft of materials or sabotage of a facility by terrorists, the threat against which physical protection systems are designed (the so-called "design-basis threat") should be reevaluated and upgraded when circumstances warrant.

5. ***Power reactors should be protected against vehicular threats.***

The size of exclusion zones at nuclear power reactor sites should be reexamined to ensure that the zones are large enough to neutralize the possible catastrophic consequences of a truck bomb set off at the perimeter fence. All reactor sites should be modified promptly with barriers to shield critical areas of the plant against potential consequences of truck bombs set off on-site. This may require revising the design-basis threat to include protection against vehicular access—a requirement not included in U.S. licensing regulations, for example.

6. ***Research reactors should have adequate security provisions against terrorists.***

Existing research reactors at universities and elsewhere should be reevaluated for the purpose of creating exclusion zones and installing improved security measures to protect against the consequences of potential sabotage by terrorists.

7. ***Reactor safety designs should be reexamined to protect against an accident caused by terrorists.***

As part of the worldwide reexamination of nuclear safety in the aftermath of the Chernobyl accident, there should be a reevaluation of the contribution of sabotage to the risks and consequences of a severe reactor accident. These findings should be incorporated into national and international reactor safety standards. Due consideration should be given to installation, at least in highly populated areas, of improved safety systems designed to be resistant to terrorist attack. In addition, information should be widely shared on new technologies for safety systems that prevent tampering with controls.

8. ***IAEA physical-protection guidelines should be reviewed and updated.***

Similiarly, the IAEA's physical-security guidelines, which were published in 1977, should be reviewed with a view to assuring that they deal with the current terrorist threat, and the new protective standards should be implemented at civil facilities worldwide.

9. ***Protection standards should be spelled out unambiguously.***

These and other protective standards should be spelled out in detail at the highest administrative levels to ensure unambiguous implementation at each facility.

Background

Protection at nuclear facilities varies from country to country and often from facility to facility. Most physical protection programs originally were modeled after those used in the United States on the basis of U.S. requirements governing transfers abroad of technology, equipment and materials for nuclear power and research programs. The United States continues to visit some foreign facilities where U.S.-supplied nuclear materials are stored and used. Based on what is publicly known about U.S. and other nuclear programs, defenses against attack from the outside and against the insider threat may not yet be sufficient. The discussion that follows emphasizes the U.S. experience, but the observations generally apply to physical protection in other countries as well.

Containment structures at nuclear powerplants are formidable, but they could be overcome or bypassed by terrorists, depending on the degree of determination and sophistication of the attackers and on whether the attackers have managed to compromise employees on the inside. Although truck bombs are unlikely to break containment structures, they can cause sufficient damage to essential systems to possibly lead to radioactive releases in the event of a core melt.

Most research and production reactors have less extensive containment systems than power reactors. The designs of these reactors should be reexamined to determine whether containments, or safety

features that compensate for the absence of a containment, should be added. An additional problem is that most research reactors do not have exclusion zones and are not otherwise protected against truck-bombs. Many of them are located on university campuses where security is generally light.

The U.S. Department of Energy (DoE) and the U.S. Nuclear Regulatory Commission (NRC) have developed threat models against which physical protection systems have been designed. There are several problems with these models, however. The models were designed a decade ago when the threat of nuclear terrorism was thought to be mostly from anti-nuclear protesters. Today's wider range of threats is not covered by the models. For example, the NRC's "design basis threat" does not require protection at a reactor against more than one insider working with "several" outsiders. And there is a need to make sufficient use of background checks of security forces and maintenance personnel, who could be key to a successful terrorist operation.

The DoE has its own protective system criteria but security standards vary and field offices are often left to their own interpretations. In some cases, a lack of agreement on threat characteristics can result in an ineffective system against certain classes of intruders; yet that system will still be within published security guidelines.

A 1984 Congressional investigation of specific instances of physical security problems at U.S. nuclear weapon facilities disclosed "nuclear test devices highly vulnerable to theft"; attitudinal problems and administrators who have covered up security problems; guard forces with less than 1 percent chance of interrupting an attacking force; "major deficiencies" in the management of the physical protection program; and, in the words of the chairman of the investigating committee, evidence that key officials "had put this nation's national security and public health and safety in serious jeopardy." Substantial improvements in physical protection have been made at these facilities since the disclosures were made.

While the Defense Department has developed equipment to provide electronic detection of an adversary force well before it reaches the perimeter fence of its nuclear-weapon installations, there is no requirement at the Department of Energy nuclear-weapon facilities other than for detection by humans beyond the perimeter fence. Consideration should be given to use of DoD research and equipment, such as foliage-penetrating radar.

In addition, the Nuclear Regulatory Commission has not required protection against the truck-bomb threat. Nor has it required, at least in areas of high-population density, the backfitting of reactors with new safety features that are designed to be resistant to terrorist attack. For example, there is a bunkered emergency core cooling system that is designed to ensure flooding of a reactor core with cooling water even if terrorists, with the aid of insiders, take over a control room and attempt to cause a core meltdown. The system, now being used in West Germany, Switzerland and other West European countries, goes into operation automatically and can be overridden only from controls within a penetration-resistant bunker isolated from the rest of the plant. The costs and benefits of such an approach need to be considered as a means of protecting against terrorists. Finally, NRC regulations that are intended not to require utilities to provide protection of their nuclear facilities in time of war against "enemies . . . whether a foreign government or other person" need to be reexamined to make clear that protection against terrorists in peace-time situations is required, at least for plants near highly populated areas.

IV. Intelligence Programs

1. ***National authorities should task their intelligence agencies to apply sufficient resources to the threat of nuclear terrorism.***

The Task Force recommends that governments task their intelligence services to commit the resources needed to detect, deter and, if necessary, to thwart a specifically nuclear terrorist threat. Only by having governments take the threat seriously will the essential early indicators be detected and opportunities for preemptive action be gained.

2. ***Concerted efforts to promote cooperation among national intelligence services, including those of the U.S. and U.S.S.R., should be pursued as part of the effort to counter the nuclear terrorist threat.***

Because of the increasingly international nature of terrorism, and of the nuclear threat in particular, a high priority should be placed on increasing the degree of cooperation among national intelligence

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services, including the possible sharing of information between the superpowers.

3. ***National intelligence agencies should look for early indicators of nuclear terrorism.***

In particular, intelligence services should look for early indicators of terrorists or their state sponsors seeking to acquire a nuclear weapon or material or to attack a nuclear reactor. One such indicator would be an attempt by terrorists to gather information on civilian or military nuclear installations or shipments, including an attempt to infiltrate the work force. Another indicator would be an increase in concerted action by terrorist organizations from more than one region, especially if recruitment of technicians and acquisition of chemicals and other items needed for weaponsmaking are involved. Acquisition of high-technology items that could be used in a bomb-building project would be yet another possible indicator.

4. ***National intelligence agencies should develop behavioral and political profiles of potential nuclear terrorists.***

Intelligence services should focus on improving understanding of terrorist psychology by means of behavioral and political profiles of terrorists, their leaders and their state sponsors, and by means of analyses of the group psychology that dominates the behavior of terrorist organizations. Such improved knowledge can help in better understanding and estimating the restraints and incentives applicable to those groups and countries that pose the greatest risk of terrorist nuclear violence. This improved understanding would help clarify the tactics and policies most likely to deter them.

5. ***National intelligence agencies should prepare plans on how and when to inform local officials of a credible nuclear threat.***

National intelligence agencies should prepare detailed guidelines for deciding when and how to inform local officials and the news media once a nuclear threat is deemed sufficiently credible. This represents a dilemma because such a threat, once disclosed, may cause panic and the loss of many lives in the ensuing chaos; if not disclosed, many more lives could be lost in a nuclear disaster if the threat proves to be real and is carried out.

6. ***National centers for analyzing intelligence on terrorism should be established and should give high priority to the nuclear threat.***

The Task Force views favorably the recent formation in the United States of a national "center to routinely analyze intelligence on terrorism," as recommended by Vice-President Bush's Task Force on Combatting Terrorism and urges that this become a model for other governments, as well. We recommend that these centers give high priority to the collection of intelligence on potential nuclear threats.

Background

The collection of intelligence is an important defense against nuclear and conventional forms of terrorism. Intelligence services have begun to develop substantial "assets" to help other government agencies combat terrorism and to cooperate with other national intelligence services in this effort. Exchanges of information among Western intelligence, security, and law-enforcement organizations, local and national, are clearly advisable, and generally can be done without revealing sources and methods of the collectors.

As discussed below in recommendations for U.S.-Soviet cooperation, efficient and accurate exchanges of information between the superpowers can be extremely important at a time of crisis provoked by a nuclear threat or explosion by a third party. The superpowers share an interest in identifying and controlling any terrorist group going nuclear. In anticipation of such a contingency, there should be a special effort to establish a separate channel for the flow and analysis of information between the superpowers. The two countries' interests could differ, and may conflict, in situations where terrorist operations are directed primarily against the other superpower and its allies. Nevertheless, sharing information could help to identify and control terrorists who seek to raise tensions or trigger nuclear conflict between the superpowers, and could deter nuclear-capable states from supporting international terrorists.

The threat of nuclear terrorism poses special problems for intelligence services. These services cannot afford even one mistake in providing sufficiently timely, accurate and reliable warnings. Intelligence is also the last line of defense—an essential ingredient for effective action to render a threat inert or to keep it from materializing.

At the same time, intelligence services have to avoid false alarms which could create public panic, spontaneous evacuations, massive mobilizations, intrusive searches and surveillance and other disruptive or restrictive measures. The difficulty of ensuring true warning while avoiding false alarms will be greater if nuclear hoaxes become more frequent or technically credible. In response, policymakers are likely to subject apparent threats to increasingly stringent tests before crediting them as genuine, and this raises the risk of failure to warn and compounds the need for good intelligence on the intentions as well as the capabilities of the terrorists. Intelligence services need the capabilities to do the necessary socio-psychological analyses.

In addition, intelligence services have to be on the lookout for certain early warning indicators including the acquisition of of high-technology items and special chemicals needed for processing of nuclear materials for weapons, the recruitment of nuclear scientists, the infiltration of staff on U.S. bases where nuclear weapons are stored, and the unusually close coordination of terrorist groups. European terrorist organizations have a very limited membership—perhaps 20 active members per organization. To mount a serious assault to obtain a weapon or sabotage a nuclear power plant it is possible they would recruit reinforcements.

Early detection of nuclear terrorists could be made difficult by the terrorists' own security measures that may approach the sophistication of intelligence operations and nuclear-weapon programs of small states. Moreover, in contrast to such states, nuclear terrorists are more likely to be anonymous, to be without assets whose threatened seizure or destruction would deter their violent behavior, and to be beyond the influence of anyone other than a sponsoring state whose involvement is almost certain to be well concealed. If they succeed in placing a shielded weapon in a large city, nuclear terrorists are likely to be invulnerable to most conventional countermeasures.

The long-term problem of nuclear terrorism is likely to be aggravated by nuclear and political developments in developing regions, particularly where there are unstable governments subject to violent and disorderly succession crises. In those countries which have a small but significant nuclear capability, such crises could prompt unauthorized threats by those who temporarily control weapons or weapon components, and these threats might be aimed at the foreign backers as well as domestic supporters of their rivals for power. Thus, nuclear terrorism could emerge not only in states that support other forms of terrorism and acquire their own nuclear means, but also in nuclear-armed or near-nuclear armed states that disintegrate through military coup or civil war.

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V. Civil Liberties Concerns

Physical protection and intelligence activities directed at preventing nuclear terrorism always should be exercised with the greatest vigor necessary under the particular circumstances, with full regard to the individual rights of citizens and employees.

With this principle in mind, the Task Force makes the following recommendations:

1. Screening of job applicants and surveillance of employees at nuclear facilities should be conducted in ways to ensure that employment is not denied for activities that represent the exercise of basic rights to free speech and association rather than pose a security threat.

2. Because of the potential danger of emotionally unstable employees and of the insider threat in nuclear plants, employees or job applicants who are to have unrestricted access to vital areas of a plant should be subject to psychological screening and to a check for a national criminal history, including a check of fingerprint records. Any criminal record found, however, should be available to the subject for review, correction or appeal before any adverse action is taken.

3. Plant security personnel should be authorized to use deadly force, but the conditions under which the use of deadly force is appropriate and legal should be clearly spelled out in regulations, taking into consideration the laws and customs of particular countries.

[Nuclear plant] employees have to expect that screening and surveillance appropriate to the sensitivity of the materials and equipment involved in a particular job will be carried out.

4. In the event of an imminent threat or calamity, national-security interests will prevail over individual rights. However, wide-ranging searches for nuclear devices or materials, and detention of suspects or witnesses in connection with a nuclear terrorist incident, should be undertaken with maximum restraint.

Background

The problem of balancing individual rights against the exigencies of physical protection, intelligence-gathering and law enforcement is particularly delicate in the case of nuclear terrorism. Because of the potential catastrophic consequences of an incident of nuclear terrorism, certain critical situations may well require exceptions to standard legal procedures. In this context, the Task Force takes note of the American Law Institute's Model Code of Pre-Arraignment Procedure, approved by leading legal scholars, that allows warrantless searches upon reasonable cause to believe that premises contain "things imminently likely to burn, explode or otherwise cause death, serious bodily harm, or substantial destruction of property."

With regard to day-to-day employment practices at nuclear plants, the Task Force emphasizes that employment in a nuclear plant differs in fundamental ways from most other types of employment. Therefore, employees have to expect that screening and surveillance appropriate to the sensitivity of the materials and equipment involved in a particular job will be carried out. Abuses should not occur as long as a rule of reason prevails.

The Task Force supports laws and regulations that prescribe thorough screening procedures to help ensure that only the most reliable and trustworthy individuals have access to critically sensitive areas. We regard as model legislation the Nuclear Power Plant and Anti-Terrorism Bill now pending in the U.S. Congress, provided that it is enacted with particular proposed safeguards. The bill, which would require the type of national criminal-history and fingerprint check described above, is appropriate if it pertains only to employees with unrestricted access, if the use of the records obtained are limited to only the matter at hand, and if an independent appeal is guaranteed in the event of an adverse ruling by management based on the records obtained.

The authority for nuclear plant security personnel to use deadly force as a means to deter and repel terrorists should be provided unambiguously by appropriate regional or national governments, but the authorities should spell out appropriate limits to the use of deadly force unambiguously as well.

In final analysis, executive discretion, not judicial control, will be the major source of protection of fundamental constitutional rights. The executive has broad powers that can be employed in the fight against nuclear terrorism; failure to use appropriate self-restraint in exercising these powers could erode both individual freedoms and public support for counterterrorism policies.

VI. Controlling Nuclear Transfers

Nuclear transfers among nations should be tightly controlled to help prevent nuclear terrorism.

In this regard, the Task Force recommends:

1. No significant nuclear transfers should be made to a nation that is located in a zone of war or that supports or sponsors international terrorism. Such a policy, if adopted by all nuclear suppliers, would help to deter military attacks on nuclear installations and to deny to terrorists a potential source of nuclear-weapon material and know-how.*

2. Export controls and customs-police practices should be reexamined to ensure they are adequate to meet the threat of nuclear terrorism.

3. National criminal laws should be amended as necessary to provide for punishment sufficient to work as a true deterrent for violations of nuclear export laws and regulations.

4. There should be prompt and vigorous prosecution of all persons seeking to smuggle weapon-usable nuclear items out of a country.

*See separate view, in brackets, in text below.

Background

There are inherent risks in the growing availability of weapon-usable nuclear material and sensitive nuclear technologies, even if they are designated for peaceful use. For plutonium and highly enriched uranium, and the facilities which produce, process and use them, "peaceful" is a category that is simply assigned by the user.

There are risks in exporting nuclear plants and material to countries in politically tense or warring regions of the world—risks that are not necessarily mitigated by a recipient's acceptance of international safeguards or adherence to the Non-Proliferation Treaty. As seen by recent bombing attacks on reactors subject to IAEA safeguards authority in NPT-party nations in one of the world's most volatile regions, nuclear exports can exacerbate regional tensions, particularly if a recipient nation has no apparent peaceful need for weapon-usable nuclear material to be used as fuel in, or to be produced in the spent fuel of, an exported reactor. Such a situation is particularly prone to hostilities when, as was seen in these instances, the receiving country is in a formal state of war with another country in the region.

[One Task Force member is of the view that the question of states at war should not have been dealt with in a report on nuclear terrorism, and that, in any event, the criteria for nuclear transfers to nations at war should be adherence of the state to the NPT or its acceptance of full-scope safeguards and the soundness of its nuclear power program and the need of the recipient country to invest in it for its energy production. Further, according to this member, the attack by one state on a nuclear facility of another which took place in June of 1981, and which was condemned by the IAEA Board of Governors and its Conference, as well as by the UN Security Council unanimously, could create a precedent for future terrorist activity.]

Nuclear suppliers can help to reduce the risk of nuclear terrorism by not exporting nuclear materials, equipment or know-how to states that support international terrorism. In addition, suppliers should establish tight controls on the nuclear "gray market." In recent years there have been a number of instances in which individuals have been apprehended and prosecuted for smuggling or attempting to smuggle out items with direct applications to the manufacture of nuclear weapons. Several cases were not even prosecuted; those in which convictions were obtained resulted in sentences which were quite lenient, considering the severity of the potential consequences of such activities.

Among nuclear suppliers, criminal sanctions against and government surveillance of nuclear smuggling need to be strengthened. Suppliers also can improve their abilities to detect such activities and to restrict commerce in dual-use items. Sanctions should be considered for governments that direct and benefit from nuclear smuggling. The aggrieved supplier countries have not made serious attempts to deprive emerging nuclear-weapon states of the rewards of illicit action.

VII. U.S.-Soviet Cooperation

Cooperative efforts by the United States and the Soviet Union to counter the nuclear terrorist threat should be promoted to the extent possible within the bounds of vital national security interests.

In this regard, the Task Force recommends:

1. Efforts should be made to promote U.S.-Soviet cooperation on intelligence-sharing and on responses to threats or acts of nuclear terrorism. Consideration should be given as to whether joint action against a nuclear terrorist threat might or might not include the use of force by the superpowers.

2. The proposal by U.S. Senators Nunn and Warner for establishment of U.S.-U.S.S.R. Nuclear Risk Reduction Centers, whose assignments would include principal responsibility for coordinating responses of the superpowers to nuclear-terrorist threats, is a major step in the right direction for pursuing these options and should be negotiated promptly.

Background

There is a risk that a third party's nuclear weapon could trigger an inadvertent nuclear exchange between the superpowers. An unidentified terrorist bomb used against American or Soviet forces or territory during a time of high tension or hostilities, for example, could conceivably prompt such an exchange. The two superpowers have agreed to maintain safeguards "against accidental or unauthorized use of

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There is a risk that a third party's nuclear weapon could trigger an inadvertent nuclear exchange between the superpowers . . . . There is likely to be public support for the two superpowers' expansion of the Hot Line by setting up Nuclear Risk Reduction Centers.

nuclear weapons," but there are no other reported agreements of this kind by states having nuclear weapons.

Given widespread concern, according to recent polls, that such an event could prompt a nuclear war, there is likely to be public support for the two superpowers' expansion of the Hot Line by setting up Nuclear Risk Reduction Centers, along the lines proposed by Senators Nunn and Warner.

As presently proposed by the Senators, and agreed to by the U.S. government as a basis for negotiation with the Soviet government, separate centers would be established in Washington and Moscow, manned by diplomatic and military personnel of that country (not jointly manned) to maintain a 24-hour watch on events with the potential to result in nuclear incidents. The Centers would be linked by communications equipment covered by the existing Hot Line agreement. Designated liaison officers from the Soviet Embassy would be given access to the U.S. Center under controlled escort on a periodic basis, and vice-versa. The Centers would serve as communications links for all required military and arms-control notifications, such as nuclear-weapon and missile tests and military exercises and serve as a meeting place for ministerial-level and other discussions relating to risk-reduction and confidence-building measures. In May, the United States and the Soviet Union met for two days in Geneva to begin exploratory discussions on the establishment of these centers.

Further refinements proposed by the Senators but not yet agreed to by the Administration are joint U.S.-Soviet manning of each center; sharing information, establishing procedures and maintaining close contact with regard to nuclear threats or acts by terrorists or other unauthorized parties; and upgrading Hot Line communications to include voice and tele-conferencing systems.

The United States and the Soviet Union have a special responsibility to take the lead in preventing nuclear war. They already have negotiated several agreements related in some way to the problem of nuclear terrorism. These include pacts on nuclear weapons proliferation, nuclear weapons protection, the Hot Line, accidental firing of nuclear weapons and the protection of international transport of fissile material. The two countries also shared intelligence on an impending nuclear test by another country in 1977.

Effective measures for preventing terrorists from acquiring nuclear explosives, or triggering a nuclear war, can be promoted through a joint superpower effort to strengthen the existing non-proliferation regime. Despite their differences, the United States and the Soviet Union have shared a leadership role in expanding implementation of the NPT. But they are likely to be less effective in that role if they do not seek to negotiate a reduction in their own nuclear arsenals and a Comprehensive Test Ban as required by both the Non-Proliferation and the Limited Test Ban treaties. If they were to negotiate, the two superpowers would be in a stronger political position to assert leadership in reducing the national-proliferation threat and that of nuclear terrorism as well. (See "Appendix: For Further Consideration.")

VIII. Arms Control Initiatives

To help promote an international climate that inhibits the spread of nuclear weapons to additional nations or to terrorists, efforts to reverse the nuclear arms race should be pursued by all nations. The superpowers together have a special responsibility to pursue negotiations in good faith toward cessation of the arms race because the degree of reliance they place on nuclear weapons has an influence on their spread.

The Task Force, recognizing that the process of nuclear arms control is related to the special effort to prevent nuclear terrorism, makes the following recommendations:

1. The United States and the Soviet Union should pursue current efforts to negotiate deep cuts in their strategic arsenals with a view toward lessening the threat from nuclear weapons by reducing the risk of early use, improving strategic stability and maintaining credible nuclear deterrence.

2. Ongoing efforts to reduce the size of nuclear arsenals should include the smaller battlefield weapons that are most susceptible to attack or theft by terrorists.

3. Additional nuclear-weapon free zones, which would reduce potential access to nuclear weapons,

should be negotiated where it proves consistent with the security interests of the nations concerned.

4. In meeting obligations under existing treaties, all nations should examine the anti-terrorist benefit which would accrue from a strictly verifiable comprehensive test ban.

Background

The Task Force notes that the size and destructive power of the nuclear arsenals of the United and the Soviet Union affect the fate of all nations. Although the arms race between the superpowers has limited implications for the nuclear terrorist threat, there are some important effects that should be addressed. One such effect is that the existing nuclear arsenals present direct targets for attack or seizure by terrorists. Another effect is that any additional nations acquiring nuclear weapons will provide enhanced points of access to nuclear terrorists.

The Task Force recognizes that the motivations of countries and of terrorists seeking nuclear weapons need not be directly and immediately affected by the behavior of the nuclear-weapon states. But the continuing heavy reliance on nuclear weapons, combined with the failure to fulfill solemn promises and legal obligations under the Limited Test Ban Treaty and the Non-Proliferation Treaty to pursue negotiations toward a Comprehensive Test Ban and a significant reduction in nuclear armaments, serve to create an international political climate more conducive to nuclear proliferation and to nuclear terrorism. The lack of progress toward nuclear arms control conveys a legitimacy to nuclear weapons that may eventually influence the considerations of nations and terrorists. It divides the international community and lowers the political barriers to nuclear proliferation and nuclear terrorism which perpetrators have to overcome.

The Task Force, therefore, emphasizes the importance of efforts to reduce the size of nuclear arsenals. Current negotiations to reach agreement on reductions in strategic and intermediate-range weapons need to be supplemented by negotiations and other efforts to reduce battlefield weapons without compromising alliance security. Considerable efforts are underway within NATO and other deployment areas to upgrade the protection of these relatively small, tactical weapons by human and electronic means. It is clear, however, that the best protection for these weapons against terrorists would be to reduce their numbers. Hence, the 1983 NATO decision to bring the number of nuclear weapons deployed in Europe down from 7,000 to 4,600 by 1988 is highly commendable. Further reductions in battlefield weapons should be added to the agenda of the current arms-control talks, and, independent of these negotiations, NATO should continue the review of its posture with a view to further reductions.

In addition, the Task Force believes that establishment of Nuclear-Weapon Free Zones, such as those provided by treaty for the Latin American and South Pacific regions, can help to control the spread of nuclear weapons and serve as the basis for regional cooperation to prevent nuclear terrorism in several regions. The Task Force urges, therefore, that concerted efforts be made regionally and through the United Nations to establish such additional zones as is agreeable to the nations concerned and to consider broadening their scope to make them free of nuclear materials usable in weapons as well as of weapons themselves.

Finally, we recognize the obligation of pursuing good-faith negotiations toward a Comprehensive Test Ban as provided under the Limited Test Ban Treaty and the Nuclear Non-Proliferation Treaty and of achieving a universal prohibition upon nuclear-weapon test explosions. Negotiation of a test ban might well help in achieving universal solidarity against efforts by terrorists or their state sponsors to "go nuclear." A substantial majority of the Task Force members believe that negotiations toward conclusion of a Comprehensive Test Ban Treaty should be resumed and that both superpowers and the other nuclear-weapon states should fully cooperate in establishing the means for strict verification in order to make the Treaty a reality.

The general disappointment expressed at the Third NPT Review Conference over the lack of progress toward nuclear arms control and disarmament was a clear signal that the non-proliferation regime—which is also the basis for fighting nuclear terrorism internationally—will be in jeopardy as long as the nuclear arms race continues unabated. Arms control is essential to supporting the fundamental international consensus in the battle against nuclear proliferation as well as nuclear terrorism.

The lack of progress toward nuclear arms control conveys a legitimacy to nuclear weapons that may eventually influence the considerations of nations and terrorists. It divides the international community and lowers the political barriers to nuclear proliferation and nuclear terrorism.

Transport [of weapon-usable nuclear materials] whether domestic or international, will remain the weakest link in defenses against nuclear terrorism.

IX. Convention on Physical Protection of Nuclear Materials

The Convention on Physical Protection of Nuclear Materials should be ratified promptly.

1. The Task Force recommends that the Convention on the Physical Protection of Nuclear Materials, which has not come into force for lack of accessions, should be ratified promptly. It is particularly important to secure ratification by the 11 members of the European Economic Community, which would provide more than the needed number of accessions. The Convention, although chiefly directed to shipments of peaceful nuclear materials between nations, does define a large range of nuclear terrorist acts and requires parties to make them criminal offenses and to provide for the prosecution or extradition of offenders under domestic law. The Convention represents an important step toward international cooperation to prevent nuclear terrorism.

2. At the same time, urgent steps should be taken bilaterally and through the International Atomic Energy Agency to establish more stringent minimum requirements for protection of weapon-usable nuclear materials while in *domestic* use, storage or transport worldwide.

Background

The Convention, which applies to "nuclear material used for peaceful purposes while in international transport," was agreed to in 1980 but has not come into force because only 16 of the required 21 states have adhered to it. Ratification by the EEC members would not only bring the Convention promptly into force, but would do so for many of the countries most concerned about terrorism. When the convention was being negotiated, there was an effort to have the specified protection levels apply to materials in domestic shipments and programs, but this was resisted by many states as an intrusion into their sovereignty. Even the Convention's language dealing with international shipments was modified because of this concern. The measure does have other requirements that apply domestically, including obligations on each party to adopt national statutes defining such crimes as theft of nuclear materials and threatening to use stolen material to cause serious harm. In addition, there are provisions on prosecution or extradition of individuals who engage in criminal acts against domestic storage, use or transport.

The United States, for its part, passed implementing legislation extending coverage of the Convention to nuclear material used for military purposes if an offense is committed within the United States' territorial, special maritime, special territorial or special aircraft jurisdiction, or if an offense is committed by a U.S. national.

However, transport, whether domestic or international, will remain the weakest link in defenses against nuclear terrorism, even at such time as the Convention comes into force. Where weapon-usable nuclear materials are used in civil or military programs, application of strict standards for protecting these materials sufficient to withstand a credible terrorist threat is needed. There are substantial political and technical obstacles to accomplishing this.

The principal nuclear suppliers now provide that all transfers that trigger the application of IAEA safeguards should also be placed under effective physical protection domestically, taking IAEA guidelines into account, and that the supply agreement should specify the protection levels. The problem is that the IAEA guidelines are limited to such conventional means of guarding dangerous and valuable material as armed guards, alarm systems, physical barriers and special containers, and do not specify the most sophisticated means now available to protect weapon-usable nuclear material, such as satellite monitoring of materials in transit, as has been done for a plutonium shipment on the high seas.

It is imperative that these guidelines be upgraded; the most feasible way to accomplish this is through early action by the IAEA with strong support from all parties to the convention. The Chernobyl accident, which has prompted efforts through the IAEA to examine international cooperation in such areas as emergency response and information exchange, may serve as a spur to such action.

X. Role of Emergency-Management Programs

For there to be effective response at the state and local levels to a nuclear terrorist emergency, there should be cooperation by national governments in providing adequate resources and intelligence information.

1. Emergency management organizations at the regional and local level should be provided the fiscal and human resources needed to cope effectively with a threat or act of nuclear terrorism.

2. In particular, there should be consideration of what arrangements can be made in advance of a nuclear-terrorism crisis to ensure the sharing of information by national intelligence agencies on a timely basis with selected regional and local officials during such a crisis—information needed for decisionmaking on evacuation and other protective measures.

3. The issuance of security clearances to emergency management officials is an essential first step.

Background

The danger of nuclear terrorism poses a major domestic threat to any nation's emergency-management system, as well as to its social and civil structure. Open societies are particularly vulnerable to a terrorist attack, and nuclear violence poses exceptional risks and difficulties. Counter-terrorism is not the province of emergency-management officials; intelligence and law-enforcement agencies and the military have the lead roles. Yet, ultimately, protection of the population is the responsibility of the emergency manager, acting on behalf of the chief executive officer of the region or municipality. Much needs to be done to ensure that the manager has the resources and the information necessary to take the requisite precautionary and/or protective measures in a timely manner in a terrorist-provoked nuclear emergency.

Local emergency-management organizations, as well as many regional organizations, often lack the wherewithal to respond effectively to a nuclear terrorist threat adjudged to be genuine. Many are overworked, underfunded, understaffed, and presently do not have the means to obtain the technical and intelligence information needed to advise the chief executives of their jurisdictions as to appropriate population protective actions in an ensuing nuclear terrorist incident. Since they cannot be expected to cope with a nuclear explosion or a provoked nuclear accident *after* the worst has happened as well as they would before the event, every effort should be made to increase their capabilities before a crisis develops. There should be an examination of how to provide for greater cooperation between governments at the national and local levels when responding to nuclear contingencies. Of particular importance is the sharing of intelligence information by national authorities with selected regional and local officials when nuclear threats are received and assessed.

Evacuation and sheltering may be the primary emergency-management responses to a nuclear terrorism incident that proves real. Carefully conceived plans could be prepared in advance to facilitate mass evacuation when sheltering is inappropriate. The sharing of intelligence and the planning of evacuations each requires clear understandings as to how sensitive information is to be handled and how and when the news media will be informed of developments in such a crisis. As we explore in the next section, the challenge is to handle information in a manner that avoids panic to the fullest extent possible.

XI. Role of the Media

To avoid panic as the result of premature or inaccurate information during a nuclear terrorist emergency, guidelines should be established now among media and government representatives on disseminating information in such a crisis.

1. Because of the possibility of widespread panic, injury and death resulting from a credible threat by nuclear terrorists, government officials and media representatives should cooperate in planning how to provide timely and accurate information in such a contingency.

2. To the extent possible, joint guidelines should be developed in anticipation of a crisis by the responsible national government agencies with regard to how and when information will be disseminated during a crisis. The key consideration should be at what point in a crisis, if the threat proves real, there still would be time to order an evacuation in a manner that minimizes injury and death and promotes public order. Leading media representatives and state and local officials should be invited to participate in preparation of the guidelines.

Background

In covering terrorist incidents the media is presented with some very complex challenges; they must be

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A nuclear terrorist incident could involve a situation where the media become an integral part of saving lives. The success of such operations could depend on the timely disclosure of carefully selected information.

responsible, which may mean withholding information, they must avoid being manipulated, which may mean declining to cover an event that would normally be considered newsworthy, and, sometimes when lives are at stake, they must subjugate the competitive urge to be first with the news.

There are recent examples of these challenges. In some cases the media have withheld information. For example, during the American embassy crisis in Iran, some American reporters learned that six Americans known to have been in the embassy were not being held by the Iranians. The reporters further learned that those men had escaped to another embassy, which they understood to be the Canadian embassy. This had actually happened, but the information was not published until after the hostages had left Iran. Again during last year's hijacking of TWA Flight 847 with 153 hostages aboard, reporters covering the incident learned, but did not report, that one of the hostages was a member of the U.S. National Security Agency.

In other cases, the media has allowed the intense heat of competition to rule its behavior. The coverage of the TWA hijacking became a scramble by the U.S. television networks to be first with an interview with the hijackers. The networks ran promotion campaigns on the air and in American newspapers boasting about their scoops. Again, in 1983 sixty people were killed in a bomb attack on the U.S. embassy in Beirut. Reporters discovered that the U.S. had managed to intercept coded communications between Syria and Iran during the period of the bombing, and one television network and a newspaper columnist reported this fact. The coded communications stopped.

British prime minister Margaret Thatcher has encouraged the news media to restrict their coverage of terrorist actions. She has said that the media must find ways of starving the terrorist and the hijacker of what she termed the oxygen of publicity on which they depend. However, media executives in Britain, and in America, have indicated they have no intention of following Mrs. Thatcher's request. Given the increasing daring of terrorist groups and the greater lethal potential of their acts, the prospect of nuclear terrorism raises a host of new considerations with ever more serious consequences. It is one thing for the media to attempt responsible and informative coverage of the kidnapping of an American general in Italy or the holding hostage of an airplane, but the coverage of a terrorist event where a nuclear device has just exploded, or where a terrorist group is threatening to explode such a device, may call for extraordinary, and hitherto unwarranted, co-operation between the media and local and central government.

Although journalists have a healthy bias against such co-operation, the media has indeed cooperated voluntarily on occasion. In Britain, the government has successfully censored information by application of a self-denying ordinance with no legal force, known as the D-Notice, by which editors, represented by a committee, agree not to mention or discuss a topic said by the government to be of importance to national security. But a nuclear terrorist incident could involve a situation where the media become an integral part of saving lives — for example in the evacuation of towns or cities affected, or in trying to prevent panic. The success of such operations could depend on the timely disclosure of carefully selected information.

Media executives recognize that a greater degree of co-operation between the media and government might be required in certain special circumstances. And most of the media appears willing to explore ways in which their responsibilities can be carried out in concert with government. But this willingness requires reinforcement, and there currently are no continuous, formalized lines of communication on how this cooperation would work in extraordinary cases like nuclear terrorism.

In anticipation of such a crisis, government officials could conduct mock exercises with media participation, as well as prepare background materials and conduct background briefings on weapons effects, reactor accidents and other possible outcomes of nuclear terrorism. In this way, the media could become better informed, and misinformation and panic could be minimized during an actual crisis.

LONG-TERM RECOMMENDATIONS

Faced with the current phenomenon of international terrorism, common sense dictates that measures be taken to deny terrorists the means and targets to cause nuclear violence. The short-term recommendations, above, represent prudent actions to protect existing nuclear facilities, materials and weapons. They also include arms-control initiatives that are relevant to countering the threat of nuclear terrorism. We urge that they be pursued promptly.

As to the longer term, we considered the need for new international measures to deal with nuclear terrorism as well as the need to restrain new technologies that are capable of producing weapon-usable materials with ever greater ease and in ever larger quantities. Our long-term recommendations follow:

I. International Measures

1. ***All states should embark on outlawing acts of nuclear terrorism by signing and ratifying the Convention on the Physical Protection of Nuclear Material.***

As noted in the short-term recommendations section, above, ratification of the convention obligates a state to enact domestic statutes outlawing a number of nuclear terrorist acts and to provide for prosecution or extradition of perpetrators. Therefore, universal implementation of this Convention should be advocated to produce criminal statutes and law enforcement against most acts of nuclear terrorism.

2. ***International agreements in the wake of the Chernobyl accident should include measures to deal with the terrorist threat.***

The Chernobyl accident, by heightening international awareness of the consequences of a severe reactor accident, provides an opportunity for renewed cooperation to prevent nuclear terrorism. Expansion of safety-related activities should be utilized to strengthen IAEA physical-security guidelines by providing minimum standards to be followed by parties for protecting reactors and other civil facilities against the insider and truck-bomb threats in particular. In addition, safety guidelines should be upgraded to provide for designs specifically to protect against terrorists.

3. ***The UN Security Council should approve a resolution on nuclear terrorism.***

As a deterrent to state support of nuclear terrorism, the United Nations Security Council should approve a resolution whereby the Council notes the grave danger that nuclear terrorism would pose to world peace and expresses its resolve to deal with any such threat on an urgent basis, including an enumeration of individual or collective measures that could be taken by UN member states.

4. ***An agreement specifying additional acts of nuclear terrorism is needed.***

States should commence seeking to strengthen international laws against terrorist attack on and sabotage of nuclear facilities. These laws should prohibit dispersal or threatened dispersal of radioactive materials by terrorists. Specifically, a new treaty dealing with these forms of nuclear terrorism should be negotiated. It could be a protocol to the Convention for Physical Protection of Nuclear Material.

Background

Existing multilateral arrangements for cooperation against certain acts of international terrorism provide a model for cooperation among states to prevent and deter nuclear terrorism. These include the United Nations Convention Against the Taking of Hostages and the Bonn Declaration (adopted by the seven heads of state participating in the Bonn Economic Summit of 1978) directed at states that harbor hijackers of airplanes. The final communique of the recent Tokyo Economic Summit, pledging a higher degree of cooperation in combatting international terrorism, suggests the climate may be right for cooperation to prevent and deter nuclear terrorism.

One useful focus for such cooperation, as noted in the previous section, is the Convention on the Physical Protection of Nuclear Material, which is yet to come into force for lack of sufficient signatures. The Convention, in addition to establishing minimum standards for the physical protection of peaceful nuclear materials in international transit, addresses nuclear terrorism more broadly by requiring parties to enact domestic criminal statutes prohibiting, for example, theft of nuclear material or threatening to use nuclear material to cause death or serious injury to any person or substantial property damage. The statutes enacted under the Convention cover most of the Acts which constitute nuclear terrorism except for sabotage of or assault upon nuclear facilities.

The Chernobyl accident, by heightening international awareness of the consequences of a severe reactor accident, provides an opportunity for renewed cooperation to prevent nuclear terrorism [by] protecting reactors and other civil facilities against the insider and truck-bomb threats in particular.

In recent years, new technologies have emerged with a potential for easier and more efficient production of weapon-usable forms of nuclear materials.

International law relating to terrorism in general is in a formative stage. As it grows to deal with the general problem, it should be more effective in dealing with the specific problem of nuclear terrorism.

A resolution was passed by the General Assembly, on December 9, 1985. It loosely defines terrorism as "acts...in all its forms which endanger or take innocent lives, jeopardize fundamental freedoms, and seriously impair the dignity of human beings." The resolution "[u]nequivocally condemns, as criminal, all acts, methods and practices of terrorism wherever and by whomever committed, including those which jeopardize friendly relations among States and their security." The Security Council, on December 18, 1985, adopted a unanimous resolution which condemned "unequivocally all acts of hostage-taking and abduction" and urged further international cooperation "to facilitate the prevention, prosecution and punishment of all acts of hostage-taking and abduction as manifestations of international terrorism."

The 1977 Protocol I Additional to the 1949 Geneva Conventions establishes rules relating to attacks on power reactors during armed conflict. Events in the continuing war in the Persian Gulf and hostilities generally in the Middle East have raised this issue to prominence. The Protocol is heavily qualified and, by concerning itself only with attacks in time of war, does not address many kinds of attacks by terrorists. Attacks on civilian reactors are a matter of grave concern since such attacks endanger both the citizens of the country under attack and those of its neighbors. This important issue has been pursued in the multilateral negotiations in the Conference on Disarmament in Geneva by the Swedish Government, which has urged that a ban on attacks on power reactors during armed conflict be included in a draft convention on banning radiological warfare.

Turning to a more recent event of grave international concern, the Task Force takes note of the severe reactor accident at Chernobyl in the Soviet Union with regard to its implications for the consequences of a severe accident that conceivably could be caused by terrorists who gain access to a reactor. Less than three weeks after the Chernobyl accident, an extraordinary session of the IAEA Board of Governors called for negotiation of an international agreement committing signatory nations "to provide early notification and comprehensive information about nuclear accidents with possible transboundary effects." The Board also recommended negotiation of accords to "coordinate emergency response and assistance in the event of a nuclear accident." These negotiations also present an opportunity for increased international cooperation on reporting and responding to reactor accidents—cooperation that could be broadened to help prevent reactor emergencies caused by terrorists.

II. Emerging Nuclear Technologies

The development of new fuel-cycle technologies should take into account the threat presented by the growing potential for nuclear terrorism.

With this principle in mind, the Task Force makes the following recommendations:

1. Emerging technologies capable of simplifying the production of weapon-usable forms of nuclear material should be followed as a possible route for acquisition of such materials by terrorists.

2. Advanced enrichment and production technologies should be developed with restraint and used only if required to meet national energy needs.

3. Efforts to develop forms of nuclear fuel less subject to proliferation should be further encouraged in the interest of lessening the dangers of nuclear terrorism. In particular, the development of fuels containing thorium in more proliferation- and terrorist-resistant fuel cycles should be considered.

Background

In recent years, new technologies have emerged with a potential for easier and more efficient production of weapon-usable forms of nuclear materials. It is, therefore, important without unnecessarily inhibiting commercial transactions to scrutinize these processes and evaluate the extent to which they might make it easier for terrorist groups—independent or state-sponsored—to obtain or process weapon-usable nuclear materials. Intelligence services should identify the appropriate indicators so as to be able to detect initiatives by terrorists or their sponsors to set up production plants.

Most significant among these concerns is development for wide use by the end of the century or later of lasers and gas centrifuges for separating fissionable isotopes. In addition, fusion reactors are under

long-term development and could be used, at least initially, for breeding plutonium as fuel for fission reactors.

The development of commercial laser enrichment plants for uranium is receiving high priority in the United States and Europe, as well as a number of other countries. The process can also be used to recover plutonium-239—a fissile isotope for weapons. The U.S. government is planning to build such a laser plant to purify plutonium for nuclear weapons.

Laser and advanced gas centrifuge processes are being pursued commercially because they offer the prospect of lower uranium enrichment costs in the civilian fuel cycle than existing gaseous diffusion and centrifuge plants. As laser enrichment technology matures and becomes available in commerce, smaller laser enrichment plants could be acquired and operated by states, including those supporting terrorism, to separate out fissionable isotopes of uranium and even plutonium. The nature of the laser separation process makes it relatively easy to operate and hide. Detection is still possible, however, through monitoring the supply of nuclear materials or the chemical composition of emissions to the atmosphere.

Also of concern is that large centrifuge plants, designed to produce low-enriched uranium for power programs, could be altered clandestinely by states to produce highly enriched uranium, usable in weapons. This material conceivably could become accessible to terrorists. In a similiar vein, small centrifuge cascade systems could be constructed clandestinely by states to produce small but significant quantities of highly enriched uranium.

The emergence of commercial fusion power plants is still a very distant prospect. Some experts believe, however, that "ignition" could be achieved within a decade. This might open the possibility of "hybrid" power generation, in which a fusion reactor, a very prolific source of neutrons, will be used to breed plutonium in a surrounding blanket of depleted or natural uranium. Plutonium recovered from the blanket would be used to fuel fission reactors. Whether such a hybrid phase of fusion development will be widely deployed depends on future economic and energy-supply conditions. Development of the hybrid system could inject large quantities of plutonium into commerce, and this could have significance with regard to increased access to plutonium by terrorists and, of course, by nations.

On the other hand, there are some emerging fuel-cycle technologies that may affect the availability of nuclear weapons-usable materials by making them *less* accessible. The development of the thorium-cycle, for example, opens the possibility of decreased proliferation and terrorist risk relative to plutonium recycle. In its simplest forms, however, the thorium cycle still involves risks associated with reprocessing to recover weapon-usable uranium-233 from thorium, even though subsequently the uranium-233 is "denatured" by mixing it with uranium-238 before fabrication into fresh fuel. This difficulty is bypassed in one advanced concept, utilizing low-enriched uranium "seeds" and thorium blankets, where uranium-233 is burned in place in the reactor as it is formed in the thorium. Development of such fuels even for use in existing power reactors could open the way for conversion to less proliferative applications of nuclear energy in the future.

There are some emerging fuel-cycle technologies that may affect the availability of nuclear weapons-usable materials by making them less accessible.

The original concept of the U.S. Atoms for Peace proposal - to build up a global pool of power and research fuel by progressively drawing down the weapon stockpiles - was never implemented.

APPENDIX: FOR FURTHER CONSIDERATION

The Task Force discussed long-term nuclear materials policies. These policies have broad implications for the nuclear arms race and the further spread of nuclear arms and are only indirectly related to future dangers of terrorism. Since our focus is necessarily narrow—the threat of nuclear terrorism—we have made no recommendations on these policies. We recognize at the same time that the terrorist threat may pose future risks for nuclear materials beyond those already associated with the arms race and nuclear proliferation. In this context the Task Force appends to its report, without recommendation, the following approach to long-term nuclear-materials policy issues as a matter for further consideration.

PRODUCTION OF NUCLEAR MATERIALS USABLE IN WEAPONS

Current circumstances in the civil and military nuclear sectors provide policymakers a window of opportunity to inquire as to whether alternative approaches are available to minimize production and use of fuels usable in weapons. It is a time when world supplies of nuclear materials not usable in weapons are plentiful and assured and are available as economic fuels for civilian nuclear power and research programs. It is also a time when military plutonium sufficient for as many as 60,000 nuclear warheads already has been produced, and when policymakers and analysts are engaged in a review of whether more is needed now.

Proposals have been made at different times by each of the superpowers and by other nations for mutual reduction of stocks of weapon materials. The original concept of the U.S. Atoms for Peace proposal—to build up a global pool of power and research fuel by progressively drawing down the weapon stockpiles—was never implemented. Today, the superpowers have between them some 200 tons of plutonium and 1,000 tons of highly enriched uranium stored in, or available for, their weapons. These comprise some 50,000 to 60,000 nuclear warheads—virtually all in the world.

Given these circumstances, it is prudent to ask whether the means may be available to limit production of potentially explosive nuclear materials and, at the same time, to serve national as well as global economic and security interests. Such an approach would have broad arms-control and non-proliferation implications if it involved reciprocal actions taken by nuclear-weapon and non-weapon states.

1. ***What is available in the way of alternatives to further production of weapon-usable nuclear materials?***

Steps could be taken to minimize and eventually to suspend further production of weapon-usable nuclear material throughout the world, in a manner that involves reciprocal actions by states possessing and not possessing nuclear weapons.

The weapon states could take the first step by halting further production of weapon-usable materials in both military and civilian programs. This could be done perhaps in the context of arms control agreements reducing the size of nuclear arsenals, but the halt need not necessarily await such an agreement. The second step could involve suspension by the non-weapon states of production of such materials in their civil programs as those states considered justified on national economic and security grounds.

There could be allowances for limited production of separated plutonium and highly enriched uranium for long-term civil research, development and demonstration projects if sufficient fuel were not available from existing stocks. Special provisions also could be made for weapon states to continue limited production, as necessary, of highly enriched uranium for naval reactors and of tritium which must be replaced periodically in existing weapons. [One Task Force member could not subscribe to such a statement which, in his view, would seem to sanction the programs of the nuclear-weapon states.]

Reciprocal actions by the weapon and non-weapon states could be facilitated by establishment of international storage centers for spent fuel and for surplus stocks of separated plutonium and highly enriched uranium. Verification of compliance in participating states and of nuclear-material balances in the storage centers could be done by inspectors of the International Atomic Energy Agency, supplemented by national-technical means.

Such a package arrangement could be pursued with the aim of bringing it into force before the Treaty on the Non-Proliferation of Nuclear Weapons is due for renewal in 1995, and then be reviewed by the parties every five years when the NPT is subject to review.

2. ***How could such an alternative approach be made feasible?***

The feasibility of halting further production of nuclear materials usable in weapons is helped on the military side by the large stocks of separated plutonium and highly enriched uranium that already exist for use in weapons, and on the civil side by the viable alternatives to a plutonium market that exist today to permit greater reliance on uranium fuels not usable in weapons.

Under such an arrangement, the weapon states would continue the practice of recycling fissile materials from old warheads into new ones. Currently, the major source of materials for new warheads entering the U.S. stockpile is the retirement of old ones. Yet, there could be substantial arms-control value in a halt in production of additional fissile material for weapons because this effectively would place a cap on the size of nuclear arsenals.

The production of plutonium for weapons by the weapons states, now about 2 tons per year in the U.S. and a comparable rate in the U.S.S.R. would halt, and so would the production of highly enriched uranium for weapons, which the U.S. now plans to start again in the late 1980s after an absence of production since 1964. In the further event of a mutual agreement by the superpowers to deep cuts in their nuclear arsenals, the dismantling of nuclear weapons would produce a surplus of fissile material, the ultimate disposal of which would have to be agreed to and supervised by the superpowers under appropriate international auspices.

Verification of a halt in the production of new fissile material could be carried out by inspectors of the International Atomic Energy Agency with the assistance of national technical means including, for example, the use of satellite surveillance. The ability to verify such a halt was acknowledged as early as the1960s when the proposal was given serious attention by the superpowers.

Special provisions would have to be made to supply the highly enriched uranium needed to fuel naval reactors, either by transfer from the weapons inventory or, if necessary, by limited production in safeguarded facilities. Also, limited operation of production reactors could be allowed to produce tritium, which decays and is replenished periodically in nuclear weapons. This is easily distinguishable from plutonium production because of different target-preparation requirements and product separation techniques. [One Task Force member reiterated his reservation, stated in the bracketed portion above, with regard to appearing to sanction nuclear-weapon programs.]

On the civil side, within the next decade the cumulative amount of plutonium reprocessed from commercial spent fuel is expected to exceed the 200 tons the superpowers now have in their arsenals. By the year 2000, if present plans for commercial reprocessing of spent fuel proceed, some 400 tons of plutonium will have been separated by that time.

The economic and energy-security factors for recovering and recycling plutonium from spent fuel could be reassessed in the light of evolutionary changes being made in the design and operation of light-water reactors and current advances in enrichment technology. Together they could reduce uranium requirements up to 45 per cent by the beginning of the next century. Extending fuel burn-up could reduce significantly the volume of spent fuel. At the same time, the plutonium-fueled breeder reactor is not expected to have an economic advantage over current-generation nuclear power reactors fueled with non-weapon usable uranium or with thorium for several decades.

Some investments are being made in new technologies to reduce uranium consumption. But the current global pattern of uranium availability, the low prices and excess enrichment capacity, and the slump in the demand for new electrical capacity, all have reduced the economic incentives for greater uranium efficiency.

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The same global over-supply conditions may reduce pressures on importing countries to seek long-term supply assurances of nuclear fuels. Over the years, much attention has been paid to the creation of an international fuel bank and other measures designed to assure countries of fuel supplies and to eliminate the need to build their own enrichment and reprocessing plants. But in the face of the present uranium glut, countries may have little incentive to move quickly on these institutional issues. They prefer to make their purchases, at the best prices they can get, on the open market. However, the work of the IAEA Committee on Assurances of Supply on these issues is welcomed and may prove invaluable in the long run.

The result is that prospects for prompt cooperative efforts to extend and assure supplies of natural and low-enriched uranium must now be relatively discouraging unless such efforts can be integrated in an advantageous way with present needs to manage and dispose of nuclear wastes. Reprocessing of spent fuel to recover plutonium fuel could be deferred because there are now surpluses of uranium to fuel power reactors and of plutonium to use in research, development, and demonstration of the breeder reactor as a long-term energy option.

3. ***What can be done with accumulating spent fuel if not reprocess it?***

An orderly system for collection, storage and eventual disposal of spent fuel under international auspices would be needed. Without such a system, some nations under legal requirements or political pressure to dispose of spent fuel may be left no choice but to reprocess it. Excess plutonium could be collected and deposited in an IAEA-operated repository, as authorized by the IAEA Statute, and spent fuel could be collected under IAEA auspices, as well, for storage or disposal without reprocessing.

If international arrangements for collection of spent fuel were to prove impossible for lack of immediately available sites, spent fuel could be casked and stored domestically at reactor sites or at away-from-reactor facilities until such time as international repositories were arranged. Some national populations would have to be educated to the fact that spent-fuel reprocessing need no longer be regarded as an essential step in nuclear waste management.

4. ***What can be done with research reactors fueled with weapon-grade uranium?***

Another long-term concern, involving the use of highly enriched uranium as fuel in some 140 civilian research reactors throughout the world, may be on its way to solution. Annually these reactors receive fuel containing approximately 1 ton of fissile uranium, coming mostly from the United States. The widely dispersed quantities of weapon-usable uranium are potential targets for terrorists, particularly on university campuses where they are most vulnerable. Almost all of these reactors can now be converted to low-enriched fuels that have been developed and demonstrated without any significant reduction in performance characteristics. Conversion is beginning to take place, but still not as rapidly as feasible.

5. ***Conclusion.***

A reciprocal halt by nuclear-weapon and non-weapon states in the further production of weapon-usable forms of plutonium and uranium, as discussed here, could promote global as well as national economic and security interests, including a reduction in future risks of nuclear terrorism. Such an approach warrants serious consideration.

■

BIOGRAPHIES OF TASK FORCE MEMBERS

HAROLD AGNEW is the former Director of the Los Alamos Scientific Laboratory and former President of GA (General Atomic) Technologies, Inc. He worked in the group that achieved the first self-sustaining nuclear reaction, and he helped to develop the atomic bomb. He was Scientific Advisor at NATO headquarters and served as head of the Weapons Physics Division at Los Alamos before becoming Director of the Laboratory.

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GEORGE BUNN holds the Stockton Chair in International Law at the U.S. Naval War College. As General Counsel of the Arms Control and Disarmament Agency, he was one of the drafters of the Nuclear Non-Proliferation Treaty of 1968. He has been Dean of the University of Wisconsin School of Law and Professor of Strategy at the Naval War College. He has also worked for the Atomic Energy Commission and the Nuclear Regulatory Commission, serving the latter as Chairman of the GESMO panel on civil use of plutonium fuel.

REAR ADM. THOMAS DAVIES retired from the U.S. Navy to become Assistant Director of the Arms Control and Disarmament Agency. He headed the Nuclear Non-Proliferation Bureau and chaired the U.S. delegation in treaty negotiations with the Soviet Union on a comprehensive test ban and on environmental warfare. In the Navy he was an aviator and aeronautical engineer and served as Chief of Naval Development and as Commander of North Atlantic Surveillance Operations during the Cuban Missile Crisis.

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BERNARD O'KEEFE became Chairman of the Executive Committee of EG&G, Inc., after serving as the company's Chairman of the Board and Chief Executive Officer. He was a principal developer of the firing circuits for the first nuclear weapons and participated in the assembly and delivery of those weapons. He worked in the Engineering Department of the Massachusetts Institute of Technology and, with an MIT colleague, formed Radiation Instruments Co. before joining the three principals of EG&G in founding that company.

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KENNETH TAYLOR was a career diplomat in the Canadian Foreign Service from 1959 to 1984 before becoming Senior Vice-President, Government Affairs, for Nabisco Brands, Inc. From 1977 to 1980, he served as the Canadian ambassador to Iran. He received recognition for the Canadian Embassy's sheltering of six U.S. diplomats during the Iranian hostage crisis.

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ADM. STANSFIELD TURNER was the U.S. Director of Central Intelligence from 1977 to 1981. Prior to that appointment, he served as President of the Naval War College, Commander of the United States Second Fleet and NATO Striking Fleet Atlantic, and Commander-in-Chief of NATO's Southern Flank. He is the author of *Secrecy and Democracy*, published in 1985.

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BERTRAM WOLFE is Vice President of General Electric and General Manager of the company's Nuclear Technologies and Fuel Division. He is President of the American Nuclear Society, as well as a member of the Board of Directors of the Atomic Industrial Forum and the American Nuclear Energy Council. He holds a number of patents in the nuclear field and is the author of several dozen publications concerning nuclear energy.

GLOSSARY

BREEDER REACTOR - Fueled by plutonium, the breeder produces more plutonium than it consumes. The fissile material is produced both in the reactor's core and also in a "blanket" of uranium. There are several experimental and demonstration breeder reactors operating but none yet on a commercial scale.

COMMAND DISABLE - A system integrated into the storage container of a weapon which can be activated to destroy a weapon's ability to achieve a significant nuclear yield.

CONTAINMENT - A pressure resistant structure surrounding a nuclear reactor intended to contain radioactive solids, gases and water that might be released from the reactor in an accident.

CRITICAL MASS - The minimum amount of fissionable material needed to sustain a chain reaction. The amount may vary according to the type of fissionable material, its concentration, its chemical form and its density. For example, when compressed by high explosives the mass of fissionable material needed to sustain the chain reaction is reduced.

DEPLETED URANIUM - Uranium having a concentration of U-235 less than the 0.7% found in nature. It is a by-product of the uranium enrichment process.

EXCLUSION ZONE - The region surrounding a reactor or other nuclear facility inside the perimeter fence.

FISSION - The process by which a neutron is absorbed in a nucleus of fissionable material, causing the nucleus to "split" and emit more neutrons. Both uranium-235 and plutonium-239 behave in this manner.

FUSION - The formation of a heavier nucleus from two lighter ones, and an accompanying release of energy. For example, in the hydrogen bomb, which is based on fusion, hydrogen isotopes need a massive burst of heat and tremendous pressure before they will fuse to form a heavier helium nucleus and explode.

FUSION REACTOR - A device in the planning stage in which the controlled fusion of hydrogen isotopes would be contained and sustained. It could be used to conduct research, produce fissile isotopes or generate electricity.

IGNITION (FUSION) - The controlled self-sustained fusion of hydrogen isotopes in a fusion reactor.

GAS CENTRIFUGE - A rotating cylinder used for the enrichment of uranium hexafluoride gas. The heavier U-238 concentrates at the walls of the rotating cylinder leaving enriched U-235 near the center.

GASEOUS DIFFUSION - A method of separating the two isotopes of uranium 238 and 235 by passing uranium gas through a series of porous barriers. Since the lighter U-235 isotope passes through the pores more easily than the heavier U-238, the end result is a gas "enriched" in U-235. The process requires huge plants and enormous amounts of electricity.

HIGHLY ENRICHED URANIUM - Uranium in which the percentage of the fissionable isotope U-235 has been increased from the natural level of 0.7% to some level equal to or greater than 20%, usually around 90%. It is a weapon material.

ISOTOPES - Forms of an element with different numbers of neutrons in the nucleus. Some isotopes of uranium are U-235 and U-238; of plutonium, Pu-239 and Pu-240.

INSENSITIVE HIGH EXPLOSIVE - A chemical high explosive detonated only by special means. It will not detonate under accidental conditions, such as shock or fire, or if a bullet is used.

LASER ENRICHMENT - The process of using high-powered lasers to separate, for example, uranium-235 from uranium-238 or plutonium 239 from plutonium 240.

LIGHT WATER REACTOR - A reactor that uses ordinary water to moderate neutrons and to cool the core.

LOW ENRICHED URANIUM - Uranium in which the percentage of the fissionable isotope uranium-235 has been increased from the natural level of .7% to less than 20%, usually 2 to 6%. It is not a weapon material.

NUCLEAR FUEL CYCLE - The "cycle" of chemical and physical operations for mining uranium and preparing it for use as fuel in the reactor through its "burn up" in the reactor core to its removal, storage, "reprocessing" for re-use as fuel, or its disposal as waste.

NUCLEAR FUEL FABRICATION PLANT - A plant where natural or enriched uranium or separated plutonium is made into fuel elements for use in a reactor core.

NUCLEAR POWER PLANT - A plant which converts nuclear energy into electricity by means of heating water to make steam which turns a turbine that drives a generator.

NUCLEAR REACTOR - A device for containing a nuclear chain reaction that produces heat. There are three general types of reactors — power reactors producing electricity, production reactors designed for the production of plutonium-239 and tritium for making bombs, and research reactors.

NUCLEAR WARHEAD - The part of a nuclear weapon containing the fissile materials, fusion materials and related systems.

NUCLEAR WEAPON - A device that releases explosive energy through nuclear fission, or a combination of fission and fusion.

ONE-POINT SAFE - The detonation of a nuclear weapon at one point in the high explosive has a chance of no greater than one in a million of producing a nuclear explosion with a yield greater than 4 pounds of TNT equivalent.

PERMISSIVE ACTION LINK (PAL) - A mechanical combination lock or electronic coded switch alluded or integrated into a nuclear weapon to prevent use until a combination or code is inserted.

PLUTONIUM-239 - One of the two fissile materials — the other being U-235 — that are used in the core of nuclear weapons. It is made artificially when U-238 is irradiated with neutrons.

PLUTONIUM 240 - The isotope of plutonium produced in reactors when a plutonium-239 nucleus captures a neutron. It can be used in nuclear weapons although its presence is less desirable from a design standpoint than plutonium-239.

REACTOR BLANKET - A layer of U-238 or thorium-232 wrapped around the core of the reactor. The blanket is composed of atoms that easily absorb neutrons to produce fissile material. For example, uranium-238 becomes plutonium-239 after it has absorbed a neutron.

REACTOR COOLANT - A substance, usually water, pumped through the reactor core, to remove or transfer heat.

REACTOR CORE - The central part of the reactor containing the fuel elements and usually the moderator.

REACTOR-GRADE PLUTONIUM - This is recovered by an industrial chemical process from the spent fuel of a power reactor. It is usually defined to have 19% or more plutonium-240, although the amount depends on the level of exposure of the fuel in the reactor. Although less desirable from a weapon-design standpoint than weapon-grade plutonium (less than 7% plutonium-240), it can be used in a weapon.

RECYCLE - Reuse in reactors of the uranium and plutonium in spent fuel after separation from radioactive waste in a reprocessing plant.

REPROCESSING - The process by which spent reactor fuel is chemically treated so as to separate the plutonium and the uranium from the waste.

SAFEGUARDS - The system of nuclear material accounting and control administered by the International Atomic Energy Agency (IAEA) under its Statute and under the Nuclear Non-Proliferation Treaty (NPT).

SPENT FUEL - Nuclear fuel elements that are discharged from a nuclear reactor after a period of irradiation and thus contain radioactive fission products.

TACTICAL NUCLEAR WEAPONS - Nuclear weapons assigned to support the conduct of battles and deployed close to likely areas of military engagement.

THORIUM-232 - A naturally ocurring isotope of the element thorium in which fissile uranium-233 can be bred by the absorption of neutrons.

URANIUM - An element that occurs naturally in the earth's crust in three different forms or isotopes. Two are important — U-235 and U-238, the U standing for uranium and the number for the the total of neutrons and protons in each isotope. The isotope U-235 is fissile. It readily splits or fissions when bombarded with slow neutrons, but it is present only in minute quantities, about 0.7%, in naturally occurring uranium. More than 99% of the uranium in the earth's crust is non-fissile U-238.

URANIUM-233 - A fissile, weapon-usable, isotope of uranium that does not occur in nature but is made artificially in a reactor by the absorption of neutrons in thorium-232.

WEAPON-USABLE NUCLEAR MATERIAL - This is material suited for use in a nuclear weapon and is either uranium enriched to about 90% U-235 or plutonium after separation from spent fuel.

YIELD - The total energy released in a nuclear explosion usually expressed in equivalent tons of TNT.

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