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NUCLEAR SAFETY IN THE NEW INDEPENDENT STATES
AND IN CENTRAL AND EASTERN EUROPE

THE PROBLEM

The Chernobyl accident in 1986 alerted the world to a gross disparity in the attention given to nuclear safety in the Soviet Union and Eastern Europe, compared to what is minimally acceptable in the West. The problem, we learned, had three aspects: 1) design inadequacies in some key Soviet designed plants, such as the graphite-moderated RBMK; 2) substandard operational safety procedures and attention to detail in managing the production of electricity at all nuclear power plants; and 3) an almost complete lack of independent governmental regulation of the state utilities, which were devoted to fulfilling the production requirements of the latest economic plan, often at the expense of safe operation.

CURRENT WESTERN NUCLEAR SAFETY ASSISTANCE

Accordingly, since the late 1980's the United States and other western countries have engaged in an increasingly active program of nuclear safety cooperation, first with the USSR, and its successor states, and with the Central and Eastern European countries that employ Soviet designs. A major impetus for expanded cooperation came in the spring and summer of 1992, when the U.S. announced an impressive new nuclear safety assistance package for Russia and Ukraine. Then, at the 1992 Munich Summit, the G-7 undertook a serious effort to deal with the three key problems. This program was subsequently reaffirmed at Tokyo (in 1993) and again at Naples just two months ago.

Our cooperative assistance effort has emphasized near-term technical upgrades to the highest risk plants, improvements in

operational safety, and enhancement of regulatory structures. Much of the assistance has been conducted on a bilateral basis or through the TACIS and PHARE programs of the European union, with an increasing measure of coordination through the G-24 and its Brussels-based secretariat. Also, a useful multilateral instrument for funding safety improvements was established in the Nuclear Safety Account at the European Bank for Reconstruction and Development. These efforts now total roughly \$800 Million in grants for safety enhancements.

For the past several years my own government has dramatically increased its bilateral assistance efforts in nuclear safety to the countries of Central and Eastern Europe and to the New Independent States of the former Soviet Union. Much of our effort has focused on helping these nations establish and strengthen a nuclear safety culture based on a strong, independent regulator, in contrast to an approach motivated primarily by considerations of unimpeded energy production.

Since 1992 we have also been engaged in a bilateral assistance program designed to improve regional nuclear safety training at sites in Russia and Ukraine, operational safety at all sites in these countries, and near term risk reduction measures for RBMK and VVER 440/230 reactors in Russia, Ukraine and Eastern Europe, as well as providing improved equipment and training for their nuclear regulatory authorities.

We have joined with the other nations of the G-7 to emphasize to the leaders of Russia and Ukraine how important we believe nuclear safety is to the success of nuclear energy programs world-wide. And, further, the G-7 launched an important initiative at the Naples Summit to provide assistance aimed at persuading Ukraine to shut down its still operating reactors at Chernobyl -- the unfortunate symbol of all that was wrong with the Soviet approach to nuclear power.

The essence of the initiative is a package of incentives designed to enable Ukraine to replace Chernobyl with a combination of efficiency measures, alternative power sources and modern nuclear power plants. The G-7 committed itself to an initial grant package of \$200 Million for this purpose, which, combined with additional TACIS funds from the CEC and European Investment Bank and EBRD loans, is a significant commitment of western resources. We hope it will convince the new government of Ukraine to reorient its energy economy in order to encourage continued western help and investment.

The United States has also been successful in raising our nuclear safety concerns bilaterally with Russia and Ukraine at the highest levels of government. This past June, for example, I participated in the third set of meetings in a year between Vice

President Gore and Russian Prime Minister Chernomyrdin, and once again nuclear safety and the importance of a strong and independent regulator were firmly reinforced by the Vice President.

Some of these initial efforts have begun to pay dividends in terms of enhanced operational safety and fixes to some of the most pressing near-term technical safety problems, particularly in Eastern Europe. Even in Russia and Ukraine, within the limitations of reactor design and construction, there have been some impressive technical improvements. But the basic "safety culture" in Russia and Ukraine has, in my opinion, not improved significantly. In fact, the limits on our success to date highlight both the importance and the difficulty of helping these countries move on to broader and more far-reaching efforts.

ACHIEVING "SUSTAINABLE SAFETY" OF SOVIET-DESIGNED REACTORS

It is now eight years since Chernobyl, and frankly we in the west still lack confidence in the ability of Russia, Ukraine, Bulgaria, Lithuania and Armenia to manage their nuclear power systems with the same attention to safety that we take for granted in Western Europe, North America, and Japan.

Nuclear safety is like a three-legged chair. If all three legs hold up, the chair will be stable. But if one leg buckles, the chair will tip.

- The first leg is *technical and operational safety*, which is the usual focus of safety and regulatory programs.
- The second leg is *sound economics* over the long term. A nuclear program, including its regulatory aspects, must be well-funded. It must be profitable enough to permit continued investment in maintenance and training. And, it must make good business sense. An uneconomic program will eventually try to cut costs and thus compromise safety.
- The third leg is *organization and management*, under which I include good regulation, training, staffing, safety culture, standardization, responsible leadership, and realistic goals.

The technical safety situation in Russia and Ukraine is *not*, in my judgment, the most serious issue. We in the West are working with these and other countries to help them solve their most critical short term problems. The worst of these is the inadequate RBMK design in Russia, Lithuania, and until the G-7 initiative on Chernobyl succeeds, Ukraine.

Nor does the problem lie in the technical competence of the operators and regulators. More than six years of cooperative work with both Russia and Ukraine has shown us that both the regulatory authorities and nuclear power plant operating personnel are well-trained and committed to doing a good job. And there is no question that the nuclear energy profession drew the best of the former Soviet Union's massive scientific and engineering talent pool.

The problem of nuclear safety, particularly in the former Soviet Union is structural; it has more to do with the second and third legs of the stool, economics and sound management -- and the difficulty these nations are having in making the transition to market economies.

We need to redirect our nuclear safety efforts in Russia, Ukraine, and Eastern Europe *from short term measures* (such as technical fixes, operational improvements and regulatory practices), *to longer term measures* (e.g., assuring adequate resources and making firm institutional and management arrangements). The term that best describes what we need is an adjective from the environmental field -- the term "*sustainable*." In "Sustainable development" economic activities are conducted so that the needs of today's generation are met without compromising the prospects for future generations.

In this light, it is appropriate to speak of "*sustainable safety*" in the nuclear field. The task is to transform patterns of conduct in the nuclear power sector of these countries from the old Soviet model of greater production at any cost to a system where safety for posterity carries a higher value. This social, institutional, and economic transformation is likely to take decades, just as it did in the West.

Therefore, the nature of nuclear technology requires that safety efforts be "sustainable" over the long term. Nuclear units coming on line now can be expected to operate over at least the next forty years. Nuclear safety cannot be a temporary undertaking which depends on the support (financial or technical) of outsiders. Each nation choosing to use nuclear energy to generate electricity must be prepared to make a long-term commitment to establish and maintain the key elements of a nuclear safety culture which will protect the public and the environment over the long period during which the technology will be used.

So, what are the elements of "sustainable safety"? Obviously, many factors contribute to nuclear safety, and this short speech does not allow me to go into all of them. Let me say, however, that the most fundamental elements have been recently incorporated into the text of an international

Convention on Nuclear Safety, which will be opened for signature by all nations next week at the IAEA General Conference in Vienna. When that instrument enters into force it will codify a comprehensive set of principles which all nations choosing to use nuclear power should apply to assure safety.

These principles embody the elements of a nuclear safety culture. They include familiar topics such as siting, design, construction, quality control, safety analysis, maintenance, inspection and operation of nuclear facilities. They involve recognition of such concepts important to nuclear safety as "defense in depth" of reactor systems and attention to the "man-machine" interface in design of facilities. I would particularly like to emphasize two aspects of sustainable safety today. They are 1) economic restructuring and proper management, and 2) improved nuclear safety regulation.

ECONOMIC RESTRUCTURING AND PROPER MANAGEMENT IN THE FORMER SOCIALIST ENERGY ECONOMIES

Economic stability and market pricing of energy are fundamental to the development and maintenance of a safe and sustainable nuclear power program. Little progress has been made in Russia, and even less in Ukraine, toward the restructuring of their energy economies needed to pay for the safety improvements they so desperately need. We have reached the point where it may no longer be cost-effective to continue the "band-aids" of near term risk reduction, when the patient's very life is in jeopardy. They must learn the same lessons we in the West learned twenty years ago in developing our nuclear power programs.

Certain conditions must be met for nuclear power to be both economically sound and physically safe. Fundamental revamping of the energy pricing mechanism, and a commitment to allocate the maintenance and investment resources needed for technical excellence will be required before significant international investments find their way to the nuclear programs of Russia and Ukraine. Western investments are now beginning to gravitate to the Russian non-nuclear energy sector, which will make it far more competitive than the nuclear power sector. This will be highly disruptive for many in the scientific and engineering infrastructure of the former Soviet Union, as nuclear specialists look for work in other fields, and we need to be sensitive to these social issues.

In addition, *sustainable safety requires indigenous creation of certain management principles fundamental to the adoption of a "safety culture."* Until Russia and Ukraine themselves institute modern economic reforms, we in the west risk pouring aid resources down a bottomless pit. Truly "sustainable" efforts to improve nuclear safety must emerge from within these societies

themselves. This is not happening. Plant operators in Russia and Ukraine are not receiving pay for their work. Utilities are not receiving payment for the electricity they produce. Regulators face bureaucratic and legal impediments to their ability to do their jobs right.

Conditions such as these would cause strikes and brownouts anywhere else on the globe, and regulators would be shutting down the plants. And, in fact, workers' "work-in" strikes did occur this past summer in Russia, and the Minister of Atomic Energy was forced to hold a mini-summit meeting with his power plant operators to try to resolve the problem of intra-sectoral payments for fuel and energy. But in Russia and Ukraine, whether because of the tradition of a command economy, because of the desperate need for energy, or simply because of the stubbornness of the atomic energy bureaucracies there, the nuclear power plants go on operating -- under circumstances which we in the West judge to be unsafe.

In this regard I'd like to stress the importance of people and their work culture to nuclear safety. Plant operators in the FSU and CEE are very well educated and well trained, and they operate with a great deal of individual responsibility and discipline. But because of the centralized management philosophy of the Soviet Union in which functions were highly compartmentalized and communication was minimal, there is a tendency for individuals to view responsibility in the very narrowest sense. For nuclear safety to be sustainable, each worker's view of responsibility must expand. The safest and most efficient plants are those where people take responsibility of not only for their individual contributions to safety and efficiency, but also for the safety and efficiency of the entire plant. And this level of pride and sense of ownership does not arise by accident. They are the result of management actions to create a supportive, questioning environment. And this is very hard to do when you don't have the resources to pay your employees.

Tragically, the countries of the former Soviet Union, in spite of their proud technical traditions, have virtually become less-developed countries again, without the economic or managerial resources to support safe and efficient nuclear power programs. This means future assistance efforts must address general economic reforms and the total energy picture in these countries. As in the rest of their industrial sectors, these countries must find ways to pay adequate salaries, provide funds for necessary maintenance and improvements and, in general, support their nuclear infrastructures in a way which assures a high priority to safety over time.

This task will require a major and persistent effort on the part of the energy ministries of these countries and the commitment of substantial resources for upgrades, spare parts, maintenance and -- my primary topic -- effective regulation. Such efforts can not be financed on a grant aid basis by western governments. They must originate within the societies themselves, and they must increasingly draw on commercial lending through international financial institutions and involvement by the private nuclear industry worldwide. Thus, progress on nuclear safety will depend increasingly on the overall economic health of the countries of the former Soviet Union and Central and Eastern Europe, on the willingness of western commercial interests to invest in their economies, and on the operating organizations of Russian, Ukrainian and certain Eastern European plants to invest in their people in the form of good management.

THE IMPORTANCE OF NUCLEAR SAFETY REGULATION TO SUSTAINABLE SAFETY

The second important element of sustainable safety is the establishment of independent, enforceable nuclear safety regulatory regimes. Although maintaining the three-legged chair of nuclear safety is primarily the responsibility of the national planners; the energy, technology, and finance ministries; and the utilities; the regulator plays a critical role in keeping the promoters and operators focused on safety.

Thus, in addition to changing the very economic foundations their countries need to support sophisticated nuclear power programs, the New Independent States and Eastern Europe must demonstrate to the rest of the world that they have laid the legal and institutional basis for nuclear safety in the establishment of independent and authoritative regulatory regimes; including laws, institutions, public processes, and enforcement mechanisms that will give investors confidence that these plants can be operated safely. The success of their nuclear power programs is possible only if these two processes -- economic restructuring and regulatory independence -- move forward in parallel, mutually-reinforcing directions.

Establishment of a strong and independent regulatory body is, perhaps, the most fundamental step in the development of a proper nuclear safety culture that can be rigorously applied to nuclear power plant siting, design, construction, operation and management. The basic elements of nuclear safety regulation are no secret. They are derived from fundamental principles that are applicable worldwide. Four of these elements are especially important in establishing and maintaining a proper nuclear safety culture.

- o First, every nuclear nation must provide a firm *legal foundation* for a strong and independent regulatory authority

to monitor and enforce high levels of safety. Where regulators have not traditionally had the independence, or political authority, to carry out their job effectively, and when there is no effective oversight body with the power to close down nuclear power plants for safety violations, there is a tendency to cut corners to produce needed power as cheaply as possible.

- Second, the regulatory authority must have the *resources*, in terms of personnel and technical capacity, to be effective. This means a well-trained and adequately paid staff to perform on-site inspections, review plants at all stages from design to decommissioning, and analyze errors to improve operations in the future.
- Third, both the industry and regulators must apply rigorous and *binding standards* which cover all safety-relevant aspects of the nuclear fuel cycle. I also think the regulator should have the authority to turn these rigorous standards into the mandatory regulations that all operators must follow.
- Fourth, by national law or binding international commitment a state must put into place *legal liability and financial protection* arrangements which would provide adequate compensation for damage in the event of a nuclear accident, while setting appropriate limits on third party liability. Such protection holds both the nation and the nuclear power plant operators accountable for protecting the public health and safety, while assuring the public every right to redress any injury it might suffer as a result of negligence or improper operation.

Where these principles have been adhered to, a culture of safety has permeated both nuclear operations and management, leading to a successful nuclear industry. Where these have *not* been followed, the goal of electricity production has frequently led the industry to override safety objectives when the two came into conflict.

These are the main elements of the International Nuclear Safety Convention negotiated this past June in Vienna. The Convention will require each contracting party, within the framework of its national law, to take the needed legislative, regulatory, and administrative measures to implement its obligations under the Convention.

I will go to Vienna next week, following a meeting of Senior Regulators in Paris on Friday, as a member of the U.S. delegation to the General Conference of the International Atomic Energy Agency, where this Convention will be opened for signature. We

particularly hope Russia, Ukraine and the Eastern European countries sign the Convention at this time. It is crucial that they demonstrate to the rest of the world their commitment to international values regarding nuclear safety.

The U.S. Nuclear Regulatory Commission has in place assistance and cooperation with counterpart organizations in the New Independent States to help establish and maintain safety cultures that will support the dynamic process of nuclear energy development which could occur there over the next few years. International cooperation can help to improve nuclear safety in regulatory matters, to free trade, and to encourage investment, technology transfer, and non-discriminatory access to resources, technology and market, with appropriate protection for investments and intellectual property.

Such cooperation can be an important mechanism for raising the level of sustainable nuclear safety worldwide. But we have learned from our cooperative programs over the last several years that unless the safety culture grows from within the society itself, and unless it is supported by economic stability, legal authority, and the commitment of resources for the long term, it will not reach down to the operational level. It will not contribute to sustainable safety. And this will endanger the future of nuclear power; not only in that society, but also world wide.

EPILOGUE

I recently returned from an extensive visit to the Far East where I met with leaders from a number of nations with broad aspirations to build up their nuclear electric power production capabilities. The region already boasts the world's most dynamic nuclear power program. In 1992, for example, along the Pacific Rim in Asia, there were 70 nuclear power plants connected to electricity grids, and 21 nuclear power plants under construction.

In Asia, as in the countries we are discussing tonight, safe use of nuclear energy depends on many conditions. As I repeatedly said to various leaders in China, *it is not enough* to build these plants. One must commit long term institutions and resources to their safe operation, their maintenance, and their regulation; so they may be operated safely and in the national and international interest over the extended lifetimes of these major industrial facilities.

The point is, *Nuclear Power is Not for Everyone*. At its best it offers abundant energy at market prices, with low environmental pollution. And we are zeroing in on solutions to the long term waste issue. But without the key elements of

adequate economic resources, energy pricing competitive with other forms of electricity production, and vigorous governmental regulation, civilian nuclear power can become a dangerous technology that if mismanaged, can contribute to drastic instabilities such as those faced today in Ukraine.

Economic, scientific, industrial, institutional, and legal elements must all be integrated to achieve acceptable levels of sustainable safety in harnessing nuclear power to the needs of society. And, as the developed nations of the western world have discovered, concurrent with the construction of commercial nuclear power plants there is a vital need to establish strong nuclear safety infrastructures based on independent regulatory institutions.