U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

The U.S. Nuclear Regulatory Commission's International Assistance Program From the Atomic Energy Commission to Today

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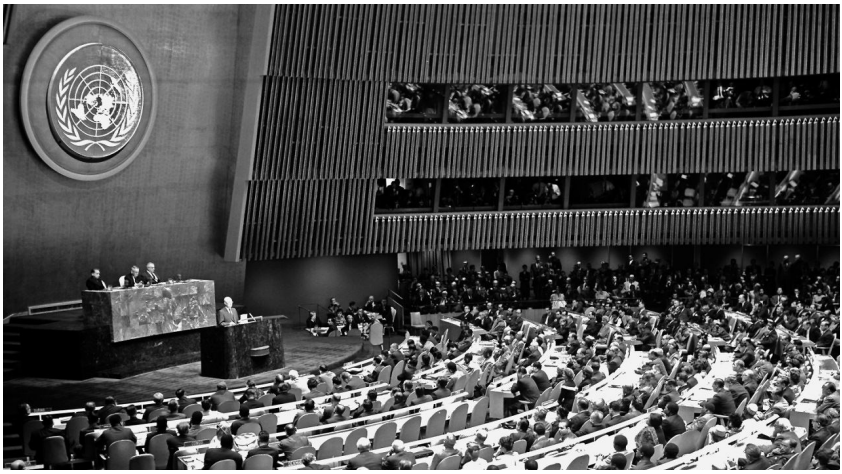
Under the coordination of the Office of International Programs (OIP), the U.S. Nuclear Regulatory Commission's (NRC) international activities support U.S. foreign policy objectives and are integral to the agency's mission to protect the nation's public health, common defense, and security. The NRC's international assistance program seeks to enhance the capability of foreign regulatory counterparts to safely and securely regulate their nation's nuclear power programs and use of radioactive material. While this assistance usually does not bring direct, tangible benefits to the NRC, these efforts contribute to broader U.S. Government interests and the global nuclear safety and security community. This overview of the program discusses the long history of the Atomic Energy Commission (AEC) and the NRC's international assistance programs and how the rationale for the program, as well as its scale and scope, have evolved through the influence of domestic and international events, the maturation of the nuclear industry, and the development of the NRC's regulatory programs.

Atoms for Peace: 1953-1974



Dwight Eisenhower delivers his Atoms for Peace address before the United Nations General Assembly, December 8, 1953. Credit: United Nations.

While the NRC's international assistance program only became a major program in the last 30 years, its origins date to President Dwight Eisenhower's Atoms for Peace program. In his December 8, 1953, address to the United Nations, Eisenhower promised to share with the rest of the world the nation's expert assistance for the peaceful uses of atomic energy while protecting against weapons proliferation and unsafe practices. Although born of Cold-War calculations, his commitment to global safety and security in nuclear energy remains the essential basis for the NRC's current programs.

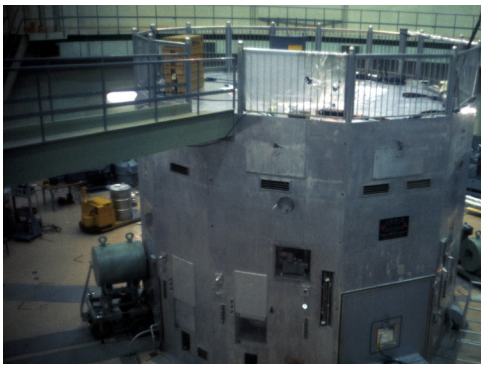
Eisenhower pledged to place part of the U.S. uranium stockpile under the control of a new United Nations body, the International Atomic Energy Agency (IAEA) and committed the nation's atomic scientists to collaborate with their counterparts abroad to explore nuclear applications in agriculture, medicine, and "a special purpose . . . to provide abundant electrical energy in the power-starved areas of the world." Opening the secrets of the atom, he predicted, "will lead this world out of fear and into peace." [1]

Eisenhower's promises found practical application in the Atomic Energy Act of 1954, which assigned to the AEC an expansive mandate

to promote the peaceful uses of atomic energy domestically and internationally while also safeguarding against potential diversion of fissionable material for military applications. In agreeing to AEC safeguards practices, cooperating nations would receive "the benefits of peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit."[2] The AEC was also tasked with ensuring that such uses came with "adequate protection" to public safety and did not pose an "unreasonable risk."

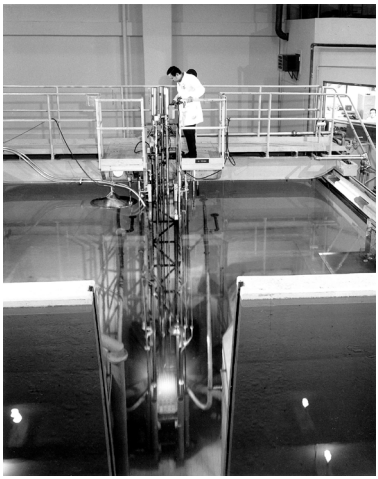
The IAEA's founding statute in 1956 gave it similar safeguards, safety, and promotional functions as the AEC, though without the enforcement powers of a national regulator. The agency was "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose." Although the IAEA's safeguards responsibilities tended to dominate its budget and attention, its mission included assistance in peaceful uses of atomic energy "bearing in mind the special needs of the under-developed areas of the world."[3] The IAEA's assistance programs became an essential adjunct to the AEC's own programs, and, in many cases, a preferred, neutral resource for developing national programs.

Atoms for Peace radically reimagined U.S. security assumptions. Driven by Soviet advances in nuclear weapons, as well as emerging commercial competition from Canada and Great Britain, Eisenhower bet that Free World security and prosperity would flourish when the U.S. abandoned military secrecy surrounding atomic energy. Looking back a decade and a half later, a National



As part of the Atoms for Peace Program, the United States provided funds for numerous research reactors (as pictured) around the world. Japan was one of the earliest recipients. c. 1960.
Credit: U.S. Department of Energy.

Security memorandum summarized the program's premise: "The U.S. has more to gain than lose, politically, economically, and in inhibiting the proliferation of nuclear weapons by associating itself with peaceful nuclear ambitions of friendly foreign countries than in remaining aloof from these efforts."[4]



Aerial image of the Puerto Rico Nuclear Center at Mayaguez (left) and staff working on its Triga research reactor (right). Credit U.S. Department of Energy.

Aloof, the United States was not. Never had a nation so zealously given away its technical and scientific capital. It lavished gifts on cooperating nations including research reactors, medical and agricultural isotopes, and provided expert assistance through the U.S. Agency for International Development (USAID). Applicants received funding to build research reactors. AEC national laboratories established "sister" laboratory programs with Turkey, Thailand, South Korea, and Colombia. When the most generous era of funding came to an end in 1962, the U.S. had extended grants for 26 research reactors, 19 other nations received equipment grants, and hundreds of foreign students attended AEC-sponsored training courses at national laboratories. The Atomic Energy Commission also provided experts to staff similar IAEA assistance programs.[5]

While containing atoms for war, Atoms for Peace proposed to lift nations out of poverty, bring advanced science to the developing world, and promote Free-World cohesion. Nations would recognize "that their best interests in the field of atomic energy are served by close association with the United States."[6] Atoms for Peace aimed to promote inter-regional

associations, too, such as the Puerto Rico Nuclear Center's specialized nuclear energy research and training with Latin American nations.

For all its generosity, Atoms for Peace also came with a catch, oversight. Beneficiary nations had to cooperate in non-proliferation measures—safeguards—through AEC and IAEA controls on the distribution of fissionable elements, known as special nuclear material. Nations participating in IAEA assistance programs were required to ensure that such aid was not used for military purposes. Thus, IAEA assistance and safeguards responsibilities supplemented a U.S. foreign policy that served as "a continuing symbol of peaceful intentions of the United States."[7] U.S. diplomats also hoped, successfully as it turned out, that a strong IAEA could induce the Soviet Union to cooperate in an international non-proliferation regime.

U.S. assistance also had implicit economic goals. The U.S. nuclear industry wanted to establish an international atomic marketplace while it still enjoyed technical advantages over competitors in Canada and western Europe. The Eisenhower administration believed, however, that it was simply doing well for the country while doing good for the world. For example, the U.S. capitalized on its uranium enrichment capabilities by providing enriched reactor fuel under "attractive conditions"—subsidies—for U.S. designed research reactors and, later, nuclear power plants. Enjoying a competitive advantage over foreign designs that operated with unenriched, natural uranium fuel, U.S. light-water reactor designs came to dominate the world market. Officials believed this dominance advanced non-proliferation goals by tying recipients to the U.S. and IAEA safeguards system.[8]

While Eisenhower offered Atoms for Peace to the free world, historic ties, economic opportunity, and Cold War calculations placed western Europe first among regions to benefit. To stiffen its ability to resist Soviet influence, the U.S. diplomats encouraged European comity and stability, particularly between former wartime rivals France and West Germany. They supported the formation of supra-national organizations, such as the European Common Market and the European Atomic Energy Community (Euratom) formed by a 1957 treaty between Belgium, France, Italy, Luxemburg, Netherlands, and West Germany. The U.S. hoped nuclear technology would serve as a counterweight to the prestige the Soviet Union enjoyed in the wake of its launch of Sputnik, the world's

first satellite in space. Euratom might provide the glue to a political alliance bound together by cooperative research and development, subsidies for enriched fuel, and favorable loans to build by 1963 up to one million kilowatts of nuclear power plants annually. [9]

These grand promises by U.S. officials for nuclear power proved premature. There were obvious diplomatic benefits in bestowing a nuclear power plant on a favored ally, but technical and safety considerations gave U.S officials pause. AEC Chairman Lewis Strauss resisted entreaties from Congress and the Eisenhower administration to develop a small power reactor for export. They were "not simple machines" when compared to the research reactors routinely exported. Strauss feared "U.S. prestige would suffer a heavy blow if, for example, a reactor provided by the United States for Spain should blow up and kill thousands of people because it was operated by people with insufficient training."[10] To avoid the "unfortunate repercussions" of a reactor accident abroad, the AEC built the demonstration Shippingport nuclear power plant near Pittsburgh, Pennsylvania under the veteran guidance of Admiral Hyman Rickover, the father of the nuclear navy. Nuclear power was not advanced enough to hold together a European alliance and was not competitive with coal plants, even in Europe where fossil fuels were expensive. By early 1961, only one proposal for a nuclear power plant had been submitted under the U.S.-Euratom joint program.[11]

As technology lagged, training and technical assistance displaced hardware grants and financing as the predominant diplomatic currency of Atoms for Peace. As early as 1957, the U.S. had made technical missions to fifty-eight countries to discuss their national programs and nuclear energy applications. Thirty-three nations signed cooperative agreements with the AEC. Even as the U.S. scaled back hardware grants and subsidies in the early 1960s, the AEC made its expertise available through the IAEA furnishing it with 20-30 experts to serve as consultants and on program committees. Outside of Europe, the generous supply of experts allowed the U.S. to curry favor with developing nations and gave the U.S. leverage to shape IAEA policy toward U.S. goals.[12]

In 1962, the AEC added a foreign assignee program for on-the-job training. Often assignees were funded by the United States as fellows through the IAEA. Training programs were popular with developing

nations, cost the AEC little, and served safety and safeguards objectives by providing a substantive benefit to developing nations that cooperated in the IAEA non-proliferation inspection regime. AEC Chairman Glenn Seaborg noted that technical assistance was one of the most beneficial activities sponsored by the IAEA. "To many countries, assistance of this kind has provided the most immediate evidence of the Agency's usefulness." The goal of this IAEA and AEC assistance, Seaborg said, was that "developing peoples of the world [could] achieve in a short time what others have achieved in a century or more."[13]

Ambassadors from non-aligned states and Great Britain look on as Soviet Ambassador Anatoly Dobrynin signs the Nuclear Non-proliferation Treaty at the White House, July 1, 1968. Credit:LBJ Presidential Library.

Even if nuclear power did not provide abundant, cheap electricity for all nations, Atoms for Peace helped the United States achieve economic, security, and foreign policy goals. By a 2 to 1 margin, U.S. low-enriched light-water reactor sales dominated foreign competition thereby benefitting U.S. vendors and non-proliferation goals. The U.S. also won over Russia in taking a positive view of the IAEA's value to a non-proliferation regime and assistance. In the sincerest form of flattery, U.S. officials took note of "Soviet imitation" of Atoms for Peace with its own limited program.[14]

Improved superpower relations in the 1960s led to an agreement on the framework for a global non-proliferation treaty. In 1965, the United States and the Soviet Union agreed non-proliferation should be a priority and the IAEA should verify safeguards treaty compliance by non-nuclear weapons states. In March 1970, the treaty received the requisite number of signatories, elevating the IAEA's centrality in an international safeguards regime. As one U.S. official commented, the treaty succeeded in "catapulting [the IAEA] from the periphery to the center of the international political system."[15]

The IAEA's expanding responsibilities for non-proliferation tended to overshadow its assistance programs, much to the consternation of developing nations. Their acceptance of the NPT regime was premised, in part, on receiving IAEA assistance in their civilian nuclear programs, and, they complained, IAEA assistance received limited attention and funding.

AEC assistance programs did not take up the slack. By the early 1970s when the Nixon administration ordered a review of Atoms for Peace, the AEC tended to defer to IAEA assistance initiatives, and U.S. officials described its assistance programs as "essentially moribund." Among more economically advanced nations, Atoms for Peace seemed to have worked too well. Allies had become competitors in the nuclear power market. Many had substantial nuclear capability and were not inclined to return U.S. generosity in exchanges of information. The United States had so thoroughly given away its scientific capital, officials acknowledged, that virtually all U.S.-government technical information on peaceful uses had been declassified and was freely available to any nation. U.S. officials were surprised when allies balked at or demanded financial compensation for disclosing technical information. "Except for purely scientific information, the days of unilateral flow of technical information in the atomic energy field appear to be ending as more nations attain a level of technological sophistication." The AEC's bilateral relations with developed nations became more transactional, worthwhile "only when there are clear benefits to be derived for the U.S."[16]

In a limited resource environment, the AEC maintained a relatively small assistance program for reactor safety that prioritized requests from developing nations that ordered U.S. technology. It looked for cost-effective assistance programs. The AEC fielded numerous requests for its experts to train other nations on safety regulation. Rather than send experts abroad, it allowed foreign assignees, funded by their home country or the IAEA, to work at its regulatory headquarters or regional offices. The AEC argued that the program helped protect the safety and good name of U.S. technology abroad and cost nothing – a net benefit really – since it gained free labor from highly educated assignees.

Assistance at the NRC: 1975-1986

Congress passed the Energy Reorganization Act of 1974, which dissolved the AEC in January 1975 and established the NRC as an independent regulator. It transferred to the new agency only the AEC's licensing and regulatory functions. The NRC's responsibilities were primarily domestic, to assure adequate protection to the public in the use of radioactive materials. Except for export licensing of nuclear technology, the legislation did not assign the agency international responsibilities. Shorn of the AEC's mission to promote peaceful uses abroad, should the NRC assist nations if there was no obvious benefit to its national regulatory responsibilities?

In the 1970s, the NRC received numerous requests for regulatory assistance from countries that purchased U.S. nuclear technology. As in the case of the Laguna Verde nuclear power plant in Mexico, NRC assistance relationships have continued to the present. Credit:Government of Mexico.

Lacking the evangelical spirit of the AEC, The NRC staff, licensees, and Congress took a parsimonious view of foreign assistance. It devoted only about two full-time staff equivalents annually for assistance to nations. It also supplied some experts for IAEA safety missions and courses. In the 1970s, mutually beneficial bilateral relationships with advanced nuclear nations and export licensing commanded most of the agency's attention on international programs. As an independent Commission with the power to disapprove export licenses, there was a perceived conflict with executive branch's authority over foreign affairs. It was an open question whether the NRC could disapprove a decision to sell nuclear technology that was supported by the executive branch. Reconciling NRC-executive international responsibilities took several years.[17]

Requests for assistance continued. Mexican regulators turned to the NRC for assistance in the construction of its Laguna Verde reactor as project management had been transferred from Mexico's national utility to U.S. contracting firms. Mexico asked the NRC for inspection assistance, funded through the IAEA, that would assign a staffer in Mexico City. Similar NRC personnel assignments had already been made to projects in Europe and Asia. Funding for assistance expanded slowly, and, by 1980, the NRC devoted about 10 person-years of staffing to the program.[18]

The NRC's reluctance to support an ambitious assistance program also stemmed from the complex foreign policy and proliferation considerations such aid raised. For example, one country requested assistance on mixed oxide fuel containing plutonium that could be converted to weapons. Countries in the Middle East requested NRC assistance in conducting safety reviews for new reactors that had been sold to them by European nations. While U.S. diplomats hoped a close regulatory relationship would strengthen the region's ties to the United States, an intimate involvement by the NRC in the licensing decisions of other nations raised thorny questions. The Commission and staff worried its reputation could be damaged if its name was attached to foreign safety reviews where it had provided only limited input. Even the IAEA safety missions the NRC routinely supported might be misunderstood as an NRC blessing of a nation's entire regulatory program. As Commissioner Richard Kennedy fretted, a country that "has little or no capability" to perform a safety assessment might take any positive statement by "the great United States guys" as enough to say, "they are in great shape." The need to protect the NRC's independence and good name limited its assistance programs.[19]

Without the assistance of nations with developed nuclear programs, however, developing nations had little guidance. There were no international safety standards to guide them, and they relied on the national standards of the exporting nation. While there was an international convention on nuclear accident liability, carefully guarded state sovereignty precluded any binding international agreement on safety standards. As early as 1974, the AEC, through the IAEA, sought to achieve a global consensus on less formal reactor safety guidelines. Since most nations outside the Soviet bloc abandoned alternatives to U.S.-designed light water reactors, there was hope an agreement could be reached. Optional guidelines would assure minimum levels of design

safety for reactors exported to developing nations. Over a 20-year period, the IAEA, the European Community, and AEC and NRC staff negotiated with other nations to establish dozens of guidelines. This loose safety framework was a positive step, but its patchwork nature made it difficult for Western nuclear regulators to articulate a common vision of what "safe enough" looked like. The IAEA's Morris Rosen noted, the general application of the guidelines "may still be many years in the future." The IAEA called on exporting nations to dispense with their ad hoc assistance efforts in favor of a program that integrated their efforts with the IAEA to transfer regulatory capability to importing nations.[20]

Before the 1986 Chernobyl accident, NRC assistance remained limited, but challenges to its environmental responsibilities in issuing export licenses elevated its importance to the agency. On several export licensing decisions, environmental groups had filed suit to compel the NRC to conduct safety and environmental reviews akin to the ones it conducted for a domestic license. Congress, too, pressed the NRC to conduct an "FAA-type certification" of reactor exports.[21] The NRC deflected demands that it render decisions reserved to sovereign nations with the alternative of assisting importing nations in enhancing their regulatory capability. In 1977, Chairman Marc Rowden observed, "one of the important ingredients of our over-all posture we have in mind is there are other mechanisms we can utilize, not in the form of a veto of an export license, but in the form of providing assistance to a country to upgrade its programs."[22]

Rowden's suggestion became reality in the early 1980s. President Jimmy Carter had issued an executive order to federal agencies to assess international environmental consequences when writing environmental impact statements (EIS), which included assessments of NRC export license decisions. Environmental organizations petitioned the NRC to assess the environmental impact on the Philippines of a Westinghouse pressurized water reactor to be built at Napot Point. The site was near the U.S. naval base at Subic Bay, just 12 miles away, and environmentalists argued an environmental assessment was necessary to protect the health and safety of U.S. citizens. Commissioners, however, believed such an EIS would conflict with international law affirming sovereign authority over public health and safety decisions.

The Commission approved the export license without a full environmental assessment and articulated a more modest view of its responsibilities. The NRC and other federal agencies need only assess the environmental impact of the reactor on U.S. territory and the global commons. The Philippine government would assess environmental impacts on its own territory. The Commission majority reconciled its decision with Carter's executive order by noting that through its assignee program and training, it could help ensure Philippine safety and environmental protection. The NRC's soft power of information dissemination and assistance programs, then, hinted at a new international role for the NRC of promoting its core safety principles and the importance of regulatory independence and self-sufficiency.[23]

The Philippine export decision was a precedent, but it did not immediately translate into an expanded assistance program. In the wake of the accident at Three Mile Island in 1979, NRC staff resources were at a premium, and the accident stirred only modest activity in the assistance arena. The NRC participated in IAEA funded exercises that brought together national representatives to witness emergency planning exercises, and it afforded foreign assignees the opportunity to participate in the site cleanup at their own expense.

Through the early 1980s, the NRC still prioritized requests for assistance from nations that purchased U.S. technology, such as South Korea, Taiwan, Brazil, and Mexico. It informed the State Department that limited budgets and higher-priority domestic responsibilities meant there was "no prospect" of increasing such assistance in the foreseeable future.

The value of even this limited program met with occasional skepticism from Commissioners, which compelled hurried justifications for its continuance from staff and the State Department. In 1985, Richard Kennedy, a former NRC Commissioner turned State Department ambassador at large, enumerated to the Commission the substantial benefits NRC assistance provided to international relations, safety, environmental protection, and non-proliferation. He reminded the Commission this was "very much 'one nuclear world' and that we should conduct ourselves accordingly."[24] The Commission did not trim back the program, but its future was hardly secure. A year later, the accident at Chernobyl Unit 4 revolutionized the international picture.

The End of the Cold War and a New Role for Assistance Programs: 1987-2005

Until the 1986 Chernobyl nuclear power plant accident, the justification for the NRC's international programs rested primarily on their benefit to the agency's domestic safety mission. NRC bilateral relations remained focused on mutually beneficial exchanges of information and research aimed at improving domestic safety programs. The domestic focus was logical since international program funding came partly from NRC licensee fees. Even the foreign assignee program, which began in 1974 as an inexpensive way of assisting developing nations, favored advanced nuclear nations, since most assignees worked on long-term assignments from developed programs. Chernobyl, the collapse of the communist bloc in 1989-1990, and the fall of the Soviet Union in 1991 made necessary a new era of global nuclear safety cooperation and provided a stronger foreign-policy imperative to the NRC's international programs.

Chernobyl's seismic influence on the international nuclear community was first felt at the IAEA. Not only were its leaders the first international visitors to the damaged facility, the Agency's programs soon expanded as nations sought an international response to the global implications of such accidents. The international nuclear community sought assurance that developing nations had adequate safety programs, and IAEA assistance programs grew in stature. The IAEA was flooded with requests for its in-depth review of nuclear power plant safety performance by an Operational Safety Review Team (OSART). The Agency's spending on reactor safety almost doubled within a few years[25] however it still remained a small percentage of the overall IAEA budget set aside for safeguards.

The elevation of the IAEA's safety role helped smooth over what had become a difficult relationship with the United States in the 1980s. The rejection of Israel's credentials at the IAEA General Conference by member nations in 1982 compelled the United States and United Kingdom's delegations to walk out of the Conference in protest. The United States only returned after Israel's status as a fully participating member was reaffirmed by the IAEA. Dissatisfaction with the IAEA even led the United States to entertain alternatives to the IAEA's safeguards role; none proved practicable. Tension remained as the U.S. advocated

for a "zero-real growth" assessed budget for the IAEA. As demands on the IAEA multiplied, the U.S. expanded its contributions to the "voluntary" assistance portion of the IAEA budget for assistance to nuclear safety programs. In 1989, the staff submitted a paper to the Commission on its IAEA activities, which noted the necessity of the voluntary budget, which had grown ten percent annually for several years. "Many in the IAEA see this voluntary assistance as the 'price' the developed nuclear states pay to obtain acquiescence in a tough safeguards policy."[26]

On the second anniversary of the Chernobyl accident, NRC Chairman Lando Zech signed a memorandum with his Soviet counterpart to create a joint coordinating committee to share information on nuclear safety issues. Credit U.S. NRC.

Chernobyl heightened the need for international dialogue and agreements on nuclear safety issues. "A radiation cloud doesn't know international boundaries," IAEA Director General Hans Blix noted. "[Chernobyl] will help foster stronger bonds for international nuclear safety." Nations quickly signed on to conventions establishing rules for mutual emergency assistance pacts and early accident notification. It took longer to reach more substantial conventions on nuclear reactor safety and improved liability compensation for nuclear accidents. Agreement on a safety convention stalled on concerns that it would override national sovereignty. As Blix noted, "It is important to retain the principle that responsibility for nuclear safety must remain with national governments. They alone can legislate. They alone exercise the power to enforce. They cannot be relieved of this duty by any international arrangements."[27] Only the end of the Cold War in 1991 spurred final agreement on an international nuclear safety convention.

As slow progress was made on an international safety convention, a superpower dialogue on nuclear safety flourished. A year before the Chernobyl accident, the NRC had reopened a channel of communication

with its regulatory counterpart in the Soviet Union that had closed after the Soviet invasion of Afghanistan in 1979. A hoped-for meeting between superpower regulators in 1986 had to wait as the Soviets responded to the Chernobyl accident. By late 1986, contacts resumed, and a successful summit meeting in late 1987 between President Ronald Reagan and the Soviet Union's General Secretary Mikhail Gorbachev produced swift progress for the NRC on bilateral relations. In April 1988, on the second anniversary of the Chernobyl accident, NRC Chairman Lando Zech met with his Soviet regulatory counterpart for a signing ceremony at the U.S. State Department to establish a joint coordinating committee of U.S. and Soviet experts to share information on nuclear safety issues.[28]

For a time, the joint committee produced a vibrant exchange between NRC and Soviet regulators, which included activities among 11 separate topical subcommittees and exchanges of inspectors. Although it was a bilateral agreement, the flow of information, training, and technical assistance and tools mostly flowed from Washington to Moscow. Along with the Department of Energy (DOE), the NRC became deeply involved in assistance to remake the Soviet safety system. The NRC urged their Russian counterparts to take advantage of U.S. computer modeling and probabilistic risk assessment (PRA) tools. The NRC also encouraged the Russians to adopt a new regulatory philosophy that focused more on root-cause analysis of reactor events, institutional reform, and lessons learned from plant events. Soviet regulators, the NRC said, needed to adopt the three pillars of the U.S. safety approach: independent capable regulation, safety-minded operations, and safe plant designs including defense in depth.[29]

The NRC's new relationship with Moscow was a significant breakthrough and became a high priority for its international programs. Fissures in the communist bloc, however, complicated the bipolar Washington-Moscow relationship that had dominated the Cold War. Even before the fall of the Berlin Wall in 1989, the United States and nuclear nations of Western Europe received many assistance requests from Central and Eastern European (CEE) nations. They wanted technical assistance, lots of it—training, advice, hardware, and reactor modeling and risk assessment computer codes—from western government agencies and the nuclear industry.[30]

The new contacts with CEE indicated assistance might shift the Cold War balance of power. If CEE nations doubted Moscow's technical competence, assistance might increase CEE contacts with the West. The DOE, NRC, and other federal agencies shed their Cold War reluctance to render aid that might benefit the Soviets. The rationale for the NRC's assistance program was shifting away from the benefits it accrued to its domestic regulatory program. Chernobyl made clear the importance of nuclear safety worldwide, and NRC priorities in international programs had to change.

The breakthrough with the Soviets, however, competed with the attention the NRC devoted to its traditional assistance program with developing nations that purchased U.S.-based technology. By 1988, safety assistance was consuming sixty-two percent of OIP resources, and there was pressure from the State Department for more.[31]

Ultimately, the NRC assigned the highest priority to its assistance to Russian and CEE regulators and improving their established programs. Reflecting the growing foreign policy importance of international programs, the NRC elevated the profile of the Office of International Programs by moving it from under the Executive Director of Operations to a direct reporting line to the Commission. Where it had previously been a liaison office between program offices and the Commission, it now gained more of its own technical expertise to make policy recommendations.[32]

Chernobyl and the collapse of the Soviet bloc reinforced the perception in the West that the Russians and their reactors could not be trusted to operate safely. "There was a visceral part of Chernobyl" that far exceeded the international response to Three Mile Island, recalled Karen Henderson, a former NRC expert on international affairs. "The Russians hadn't told people about it; the lying that went on. There was a feeling that once again the Soviets were not being honest with people."[33] At an international meeting in 1989, Secretary of Energy James Watkins urged the Soviets to "get their cultural act together" and develop a "firmly embedded safety culture of openness, critical self-assessment, and resolute corrective follow-up."[34] Suspicions of the Soviet system seemed to be confirmed when, in 1992, the Russian government and the IAEA concluded Chernobyl's poor reactor design substantially contributed

to the accident, a conclusion the Soviets had discounted in 1986 as it attributed the disaster to criminally negligent operators.

As doubts about the Soviet civilian nuclear program grew, concern in the West over the safety of Chernobyl-type graphite-moderated RBMK reactors spread to their pressurized-water reactors, known as VVERs, many of which had been built in the CEE. The VVER design was operationally similar to U.S. PWRs but the oldest Soviet model, the VVER-440/230s, lacked basic defense-in-depth safety features, such as emergency core cooling systems and containment buildings. A Western expert said of East Germany's old 230s at the Greifswald power station, "Those machines are very far off our own regulations and requirements. Not marginally off, but incredibly far off."[35] In 1990, just one year after German reunification, the government announced Greifswald's reactors were unsalvageable and closed them forever.

The technical and regulatory capabilities of CEE nations were also scrutinized. In the communist era, CEE safety regulation received direction from Moscow. The 1989 Soviet pullout left reactor operations and safety regulation in chaos. Former satellite nations did not have their own laws or regulations on reactor safety. They had limited indigenous expertise and training, a demoralized workforce, and little money. The earlier requests for assistance from the region turned into a flood.[36]

The safety problems in the former communist bloc were so pervasive that a multinational assistance program was necessary. The United States and its allies quickly agreed on what ought to be done. By 1991, a consensus hardened that former communist nations in the CEE and Newly Independent States of the Former Soviet Union (NIS) should not operate reactors of dubious safety. The World Association of Nuclear Operators recommended VVER-440/230s be closed. NRC Chairman Ivan Selin agreed, "[The CEE is] basically a dangerous area."[37]

Initially, there was no consensus in the West on a coordinated response. CEE nations depended on their reactors for vital electricity, and they disagreed that the VVER-440/230s were too dangerous to operate. There was no international yardstick to measure when a Russian or CEE reactor was safe enough. CEE nations recognized they could shop for the best answer among U.S., French, British, and German experts, agencies, and corporations. Former communist nations adapted the safety modeling

NRC staff member Jack Ramsey attends a G-24 Steering Committee meeting on Soviet-designed reactor safety, March 1994. Credit: U.S. NRC.

tools the West supplied in ways that produced optimistic assessments of safety. It was "a very dangerous slope," noted Jack Ramsey, a former senior OIP staffer. He worried that some recipient nations wanted probabilistic risk assessment tools to "cook" some positive accident probability numbers to justify continued plant operation. Nuclear experts in the West worried that NIS and CEE nations would accept assistance and technical tools without accepting a necessary change in safety culture.[38]

As the communist bloc and the Soviet Union disintegrated between 1989 and 1992, Europe and the United States established programs to encourage the formation of democratic and capitalist institutions, which came to include capable safety regulators. The IAEA and Western nations worked with nations of the former Soviet Union and CEE to develop appropriate nuclear safety legislation and regulatory bodies. The assistance programs required a complex array of funding mechanisms, national and international organizational assistance, and the talents of private corporations. The Group of 24 industrialized nations (G-24) of the Organization of Economic Cooperation and Development (OECD) developed a broad program of multilateral and bilateral assistance.[39] The United States increased its contribution to the World Bank, the International Monetary Fund, and the new European Bank for Reconstruction and Development for assistance and loans to CEE nations.

In 1989, the United States entered into bilateral agreements and assistance programs with CEE nations. In the first half of the year, Poland and Hungary gained independence from Moscow's control, and President George Bush proposed assistance to encourage market economies, political pluralism, and free elections. Congress authorized assistance through the Support for East European Democracy (SEED) Act of 1989. As other CEE nations broke away, SEED expanded throughout CEE and

similar funding, the Freedom Support Act, was later appropriated for the NIS. Through grants administered by the USAID, the appropriated funds aimed to fertilize democratic initiatives and reforms in housing, agriculture, banking, environmental regulation, and the energy sector.

The NRC benefitted from the SEED program, too. In 1989, the NRC signed bilateral information exchange agreements with Czechoslovakia and Hungary. In late 1991, the NRC received funding from USAID to support regulatory assistance to Hungary and the Czech and Slovak Federal Republic after the dissolution of Czechoslovakia in 1992. Assistance funding for Bulgaria and Lithuania followed. The NRC furnished training on nuclear safety regulation at the NRC's Technical Training Center, access to the NRC Fellowship program to allow CEE fellows to work alongside NRC staff, and membership fees for CEE regulators to join programs in accident management and code and risk assessment. By mid-1993, 34 personnel from CEE nations had received NRC training.[40]

The scale of technical assistance required by NIS and CEE nations outstripped western generosity. Safety backfits that might raise CEE reactors to western standards were estimated at $20 billion, a figure so large, some called it a nuclear Marshall Plan. Neither the United States nor even the Group of 7 (G-7) industrialized nations would fund such an ambitious program. Rather, the G-7 declared CEE and NIS nations should shutdown RBMKs and model VVER-440/230s without financing replacement energy. CEE and NIS nations chose to operate their plants anyway. Russia and Ukraine announced that they intended to finish Soviet-designed plants whose construction had been paused after Chernobyl.[41]

Western nations recognized they could neither order shutdowns nor finance major safety upgrades, and a longer-range strategy emerged to improve regulatory capability and support short-term safety upgrades for older model VVER-440/230s. More substantial upgrades were limited to newer Soviet designs, the VVER-1000 and -440/213s. In May 1992, assisting nations met at the Lisbon Conference on Assistance to New Independent States. The United States announced at the conference new funding for initiatives led by the DOE and the NRC. DOE took the lead on technical assistance. The NRC facilitated the development of modern

independent regulators in Russia, Ukraine, Bulgaria, Armenia, Hungary, as well as the Czech and Slovak Republics. Britain and Western European nations focused their programs on CEE nations most likely to seek entry into the nascent European Union (EU).

A month later, the G-7 nations met in Munich, Germany to act on a safety program developed by the Nuclear Safety Working Group at the Lisbon conference. The G-7 affirmed the Lisbon agreements that RBMKs and VVER-440/230s would receive short-term risk reduction assistance to extend safe operation for a few more years. VVER-1000s and -440/213s could receive more substantial upgrades for long-term operation. The G-7 accepted that it could not force hard strapped CEE and NIS nations to shutdown essential electricity sources when it could not fund alternatives.[42]

The NRC, too, struggled with the paradox that its assistance was essential to improving safety but might enable the continued operation of a reactor deemed unsafe by Western standards. In the past, the NRC had sometimes declined assistance when it could not be sure a recipient nation would be an effective regulator. In the former Soviet Union and CEE, it faced that dilemma repeatedly. In early 1993, the NRC met with a group of former high-level NRC experts and officials active in assessing Soviet-designed reactors. The group argued that Western nations lacked a coherent assistance strategy, and CEE nations were ignoring the West's demands to close reactors. "There is little evidence that Western recommendations to close down the less safe plants are being followed." It seemed likely Russia, Lithuania, Ukraine, and CEE nations would operate the RBMKs and VVER-440/230s "for the indefinite future." Regulators in the former Communist bloc concluded that no financial aid was forthcoming, and what was spent went into the pockets of Western contractors.[43]

The experts suggested the NRC's proper role was to invest in raising regulatory capability in nations regardless of the oversight decisions they made. Some nations, such as the Czech Republic and Hungary were becoming quality regulators, they noted, although others had a long way to go to "de-Sovietize" their nuclear programs. Former communist nations needed to be taught to be independent, given the technical tools to do the job, and "take ownership of their own safety and regulatory programs." Much of this work involved relatively inexpensive training for

plant inspections, code and standards development, computer evaluation tools, and regulations. European nations did the same, and the IAEA launched several initiatives aimed at standardizing the safety evaluation of Soviet-designed plants, and it developed PRA methodology and peer-review standards.[44]

As the United States and Europe turned to the goal of reform rather than immediate reactor shutdowns, the value of technical and regulatory assistance as an inducement to cooperation grew. President Bill Clinton considered reactor safety a priority in his negotiations with President Boris Yeltsin of the Russian Federation. In May 1993, Clinton made a substantial commitment of U.S. resources to improve reactor safety, and the two presidents agreed to create a commission on energy led by Vice President Al Gore and Prime Minister Victor Chernomyrdin. The DOE and the NRC supported preparations in crafting the U.S. position on reactor safety reform. In September 1993, Gore won from Chernomyrdin a commitment to strengthen Russia's nuclear regulatory agency, Gosatomnadzor (GAN).

The NRC worked with Russian authorities to model GAN on the NRC principles of independence, expertise, and enforcement power. The NRC Chairman Ivan Selin told Congress that the NRC's international assistance program would be a success "when the regulatory bodies in the NIS and CEE have the authority and the will to shut down nuclear power plants for safety violations. A significant portion of the NRC effort to implement the Gore/Chernomyrdin Commission mandates will be to strengthen the Russian nuclear regulator." In a 1994 report, the NRC's Office of the Inspector General praised the NRC assistance to Ukraine.

The Office of Inspector general (OIG) report noted that Ukraine operated 14 nuclear power plants without its new regulator having formal authority. The NRC provided training and helped Ukraine establish laws, regulations, and enforcement capacity. [45]

Funding for NRC international assistance came from a broader U.S.-assistance package to NIS and CEE nations. USAID funding to the NRC typically ranged from 3 to 5 million dollars per year and produced some successes. For example, the NRC and GAN developed a PRA for a Russian VVER-1000 at the Kalanin Nuclear Power Station. The NRC and Brookhaven National Laboratory cooperated with GAN and

the Kurchatov Institute to develop PRA procedures and deploy NRC-developed codes, including SAPHIRE, MACCS, and MELCOR. The decade-long project culminated in 2005 with enough technology and knowledge transfer to enable Russian experts to develop their own PRA. Carol Kessler, an NRC and State Department staff member, noted the "remarkable success" of NRC PRA education efforts in Russia. It "opened Soviet eyes to what it really meant to do a [PRA]. . . . None of them knew how their plants were built," but "what we saw over the years was the scientists on the Russian side slowly beginning to see that they weren't being given proper tools [in the Soviet system] to evaluate the reactors."[46]

While assistance improved NIS and CEE technical expertise, its failure to compel closures created discontent in the West. A Government Accountability Office (GAO) evaluation of USAID assistance found that it was difficult to measure the safety value of assistance training and noted that many RBMKs and VVER-440/230 reactors continued to operate. The NRC admitted that its assistance would continue regardless, even in Armenia which operated what experts considered one of the least safe VVER-440/230s at its Metsamor facility. The Armenians resisted economic pressure to close Metsamor from the European Bank for Reconstruction and Development. Chairman Ivan Selin admitted, "We feel for the Armenians. They're in a terrible situation in a whole lot of ways, especially where energy is concerned. We're not going to make them suffer because they do something we don't like."[47]

The emerging EU provided an extra prod to closing the reactors considered the least safe in the CEE through the stick of a new international convention on reactor safety and the carrot of EU accession for cooperating CEE nations. Responding to a request by the European Community, the IAEA held a conference in 1991 on nuclear safety. German nuclear safety chief Klaus Toepfer surprised non-European delegations with his proposal for an "international regime for nuclear safety." Arguing that "a serious accident in any country represents a set-back for us all," Toepfer suggested that the convention use existing IAEA-based standards. Toepfer asked that the convention include "internationally binding minimum requirements for safety provisions [that] can be established and implemented." The United States and Japan opposed binding international standards and were concerned that an international regime would waste resources reviewing well-established

programs rather than weaker ones. Nevertheless, the conference members agreed to work toward a convention.[48]

The final convention managed to protect U.S. and EU interests through a common Western vision of reactor safety within a collaborative framework. While any binding mechanism was a non-starter, the Convention on Nuclear Safety offered a novel solution. It obligated each signatory nation to abide by its tenets, but it was an "incentive" document. There was no verification or enforcement mechanism beyond the peer pressure exerted by nations critiquing a national program report at regular meetings. Convention standards were loosely defined and based mostly on IAEA standards and technical documents. Nuclear nations could choose to define how they met the convention's mandates. The Convention on Nuclear Safety established an international standard for cooperation and assistance. Ivan Selin declared it was "crucial" that former communist nations become signatories to the convention and "demonstrate to the rest of the world their commitment to international values regarding nuclear safety." The EU accession process provided teeth to enforce the convention's standards among CEE nations. In July 1997, the European Commission issued a road map for EU enlargement. It required that accession nations meet Western safety standards. "Promoting a 'nuclear safety culture' is thus a crucial and urgent task," noted the roadmap.[49] Accession involved difficult choices for nations such as Lithuania and Bulgaria, but they eventually closed their RBMKs and VVER-440/230s, respectively. Other nations made the regulatory transition. "Some of those regulators were very, very tough," recalled Karen Henderson. "They had been waiting in the wings all this time to really be free to do their job — the Hungarians, the Czechs—model regulators."[50]

In nations where assistance was most successful, regulators gained the expertise, clout, and independence to police nuclear safety in their countries. Assistance helped facilitate a new international nuclear community that overlaid on the existing sovereign system of reactor safety a lightly applied international framework of conventions, guidelines, and values. Dana Drábová, the Czech Republic's chief regulator, enthused about the "significant benefit" of the EU's reactor-safety harmonization efforts. "We will have common grounds for understanding what is expected of us."[51]

By 2000, assistance had achieved moderate progress. A GAO report found that almost $2 billion had been spent, mostly by the EU and the United States, to upgrade Soviet reactor safety. The decision by Ukraine to shutdown the remaining operating units at Chernobyl relieved somewhat the criticism that the program was not helping to close the most dangerous Soviet-era reactors. Hungary, the Czech Republic, and the Slovak Republic were found to have made the most progress toward adopting Western safety practices and culture. While DOE planned to wind down its expansive assistance program by 2005, the State Department wanted the NRC to continue assisting countries that needed additional support. For example, Ukrainian operators reported that they valued U.S.-assistance, particularly in developing emergency operating procedures, which encouraged them to think about safety in day-to-day operations and how to respond to events.[52]

Assistance to the nations of CEE and the former Soviet Union remade the NRC's international programs. In the name of global safety and security, the NRC decoupled its previous conditions on assistance from the regulatory decisions made by recipient nations. Where assistance had once occupied the attention of only a few NRC staff, by the mid-1990s roughly half of the 60 full-time staff assigned to support international activities were working on assistance. Between 1992 and 2007, the NRC had received over $53 million from USAID assistance to former Soviet and CEE nations for reactor safety and radioactive source security.[53]

The NRC's broad regulatory and technical capabilities were recognized as an asset to U.S. foreign policy and national interests whose assistance to other nations could expand U.S. influence. Yet, as an NRC staff paper observed, the slow progress for some "transitional" countries required a long-term view of assistance.[54] Additionally, the priority given to former Soviet nations at the expense of developing nations needed to change. Difficult choices might have to be made as USAID funds were expected to decline. The NRC took a new look at the balance between international commitments and its core responsibility for domestic nuclear safety.

As NRC leadership admitted, the agency still suffered from a short-term view of assistance programs due, in part, to the discomfort of relying

on fee recovery that did not directly benefit licensees.[55] International assistance activities began to receive general appropriation funding, particularly with the growing concern for radioactive source security and safety.

Radioactive Source Safety and Security

As important as reactor safety was, it was only part of the list of international radiation safety concerns. By the 1980s, millions of non-military radioactive sources were in use worldwide for medical applications, industrial radiography, and irradiators. While the

In 1987, this cesium source (left) used for medical procedures in Goiania, Brazil was sold to a local junkyard. Over 250 people were contaminated and four died. Twenty years later, community graffiti still recalls the incident (right). Credit: IAEA.

radiological risk from sources is relatively low, the misuse, loss, or abandonment of just a few of them has led to fatal accidents in Mexico, Morocco, and El Salvador when workers or civilians found the sources and took them home. In some cases, multiple deaths occurred.

The worst case occurred in Goiania, Brazil. A private radiotherapy institute moved to a new location and left behind a Cesium-137 source. Unaware of the source's radioactivity, local residents removed the source and medical unit from the partially demolished building to sell as scrap metal. They removed pellets of the water-soluble cesium compound, contaminating nearby homes and the scrap yard. Family, friends, and neighbors viewed the glowing material, exposing almost 250 people, forty-six severely, resulting in four deaths. In Mexico, three hundred curies of Cobalt-60 were mixed with other metals and melted at a foundry. The metal was fashioned into rebar and restaurant table legs.

Some of the items were exported to the United States and were only discovered when a truck carrying them took a wrong turn near the Los Alamos National Laboratory setting off radiation alarms. Although less severe than a reactor accident, poor radioactive source security could have cross-border consequences.[56]

Radioactive source safety and security episodes were not isolated to developing nations. Since World War II, over two million sources had been distributed in the United States to AEC/NRC licensees, and two hundred sources were reported lost, stolen, or abandoned annually. In the 1980s and 1990s, about 20 sources found their way into scrap yards to be melted down and resold. Recognizing the international implications of the problem, the NRC pressed for an IAEA seminar on radioisotope safety, which was held at the 1988 IAEA General Conference. NRC staff recommended that the NRC support IAEA Radiation Protection Advisory Team (RAPAT) inspections.[57]

The dissolution of the communist bloc added to concerns about source safety and security. The pullout of the Soviet Union from CEE left numerous "orphan sources" in those countries that were unregulated and unprotected. In 1994, a fatal cesium source incident in Estonia occurred after a source was left behind by the Soviets when they pulled out in 1989. As had been the case for nuclear power plants, NIS and CEE nations needed a new legal, regulatory, and technical framework to track and manage radioactive sources. An uptick in the smuggling of radioactive sources from NIS countries lent urgency to the task. The IAEA began working with the International Criminal Police Organization (Interpol) to develop a database of sources as well as training for member nations.[58]

In the late 1990s, the IAEA held a conference on source security and began work on standards and a voluntary code of conduct on source safety and security. On September 10, 2001, just one day before the terrorist attacks on the World Trade Center and Pentagon, the IAEA Board of Governors approved an action plan on source safety and security. The attacks further alarmed the international community about the potential of lost or stolen sources becoming radiological dispersal devices, or "dirty bombs." The NRC was instrumental in developing the code's categorization of source types. In 2003, the IAEA Board of Governors approved the revised Code of Conduct on the Safety

and Security of Radioactive Sources. A voluntary document, the Code's objective was to encourage cooperation to harmonize national laws and regulatory control of sources to ensure they were secure, safely managed, and tracked. As a result, in addition to supporting international reactor safety, the NRC's assistance program now included helping nations develop the laws and capacity to meet the Code's objectives.[59]

In March 2002 NRC and the Armenian Nuclear Regulatory Authority launched an effort to improve Armenia's regulation of radioactive sources. In this picture, NRC representatives visit an Armenian low and intermediate-level radioactive waste storage facility. Credit: U.S. NRC.

The Code was incorporated into the 2005 Energy Policy Act and officially became U.S. law and provided a framework for NRC assistance activities with nations that committed to implementing the Code. In 2002, the NRC launched a source assistance program in Armenia where it had previously established a reactor safety assistance program in 1994. Under NRC tutelage, the Armenians developed source security legislation, received source safety training, and created a national registry to facilitate source tracking in their country. Armenia is a small nation of less than three million people, which at the time, identified about 1,300 sources for the registry.

As the Armenian experience demonstrated, NRC assistance occupied a unique niche among federal agencies. While DOE's National Nuclear Security Administration (NNSA) provided technical expertise on source security, the NRC focused its assistance on regulatory issues regarding safe source management and achieved positive results. In 2003, the NRC expanded its source safety and security program. Concerned that the Caucasus region was vulnerable to terrorist groups that might use sources in dirty bombs, the State Department sought NRC assistance funded through the Freedom Support Act (FSA) of 2005 administered through USAID. This support allowed the NRC to assist Georgia and Kazakhstan with similar training and resources as its work in Armenia.[60]

Creating a source registry was only a beginning. Users of radioactive sources in each country received an education in their legal obligations and best practices for licensing and inspection. In supporting the

creation of a legal and regulatory infrastructure, the NRC was cognizant of the resource limitations of relatively small nations. Assistance was often basic but essential, such as funding to rent and remodel office space, purchase radiological measuring devices and protective equipment, and providing basic courses in radiation protection.

NRC Assistance for the 21st Century: 2006-2021

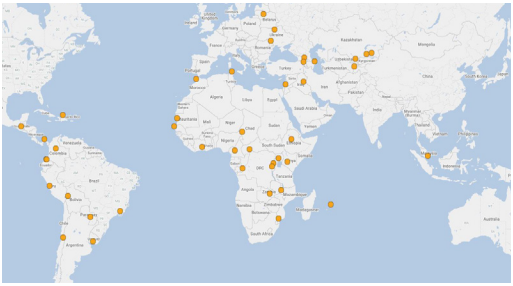
An NRC staff member instructs Mauritanian regulators in the use of ARIS source tracking software. Credit U.S. NRC.

At the turn of the century, the NRC international assistance program arrived at a crossroad. In the 1970s the NRC's international collaboration had been justified transactionally as a benefit to the NRC's domestic safety mission and to support the safe use of U.S. nuclear technology abroad. The NRC's experience with CEE nations, however, had altered the direction and motivation for the international assistance program. Aid to nations of the former Soviet Union and CEE had been offered without expectation of direct benefit to NRC programs and irrespective of a nation's technological choices. The 9/11/2001 terrorist attacks confirmed that there was a larger purpose to international assistance in its contributions to global safety and security and in advancing U.S. diplomatic and security objectives. In the next two decades, the NRC broadened its assistance program to develop regulatory capacity in emerging countries in Asia, Africa, and Latin America that planned to establish new nuclear power programs or meet IAEA standards for radioactive source safety and security.

Systematizing Assistance Programs: The Radiation Source Regulatory Partnership

In 2005, the NRC sought to systematize assistance on source safety by initiating a commercial contract to launch and implement support programs among Armenian, Azerbaijani, Georgian, and Kazakhstani regulatory authorities using NRC-developed software source tracking

systems and regulatory guidance. The NRC branded its radioactive source assistance as the Radiation Source Regulatory Partnership (RSRP). The RSRP provides support to regulatory authorities to build national regulatory frameworks that align with the IAEA Code of Conduct.



Map of countries the NRC has supported or is supporting in the area of radioactive sources through the Radiation Source Regulatory Partnership (RSRP).

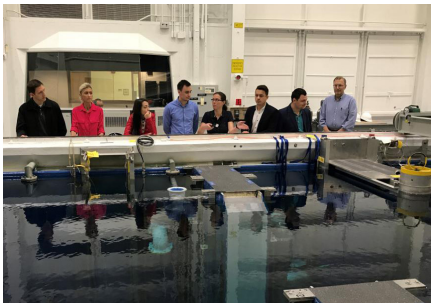
The NRC international assistance program also relies on long-standing relationships with the DOE national laboratories. It has contracted with Sandia National Laboratory to strengthen regulatory oversight in Iraq for the utilization, storage, and disposal of radioactive materials as that nation continues to recover from many years of war. Sandia has assisted in the development of laws and regulations covering nuclear materials, the creation of an independent regulatory entity, licensing of low-level waste storage facilities, and radioactive materials inspection. Since the early 1990s, Brookhaven National Laboratory (BNL) has supported technical and administrative activities for the NRC's assistance activities. Initially, BNL provided technical assistance in the development of the full-scale probabilistic risk assessments for Soviet-designed reactors. In recent years, BNL's reactor safety work has included training and document development for reactor modeling computer codes, consequence analysis, probabilistic risk assessment, waste storage and disposal, and modeling of spent fuel storage cask degradation.

The Universidad Especializada de las Americas in Panama confers Master's Degrees in Radiation Protection at a graduation ceremony in 2015. The NRC's RSRP has supported the program since 2010. Credit: U.S. NRC.

As the assistance program reached maturity, the Commission sought direct congressional appropriations. The funding sources that underwrote NRC post-Cold-War activities, such as the SEED Act and the

Freedom Support Act, had begun to decline and could not be applied to activities in Asia, Africa, or Latin America. At the same time, there was a lack of funding coordination across federal agencies for international nuclear safety and security assistance. Commissioner Edward McGaffigan, a former congressional staffer, put his finger on the problem when he told Janice Dunn Lee, the NRC's Director of International Programs, that the NRC confronted a persistently uncomfortable situation of extending "a tin cup" to other federal agencies to pay for a program of importance to the United States government. Regular appropriations were necessary. [61]

Commissioners Jeffrey Merrifield and McGaffigan took the lead in making the case to appropriations committees on Capitol Hill, and, after McGaffigan's untimely death, Peter Lyons, another former Senate staffer turned Commissioner, kept the issue alive in the halls of Congress. The NRC's cause was buttressed by a 2007 GAO report, which concluded that U.S. radiological source security efforts would benefit from direct appropriations to the NRC. In 2008, Congress approved $2,150,000 to the NRC for foreign source security programs.[62]

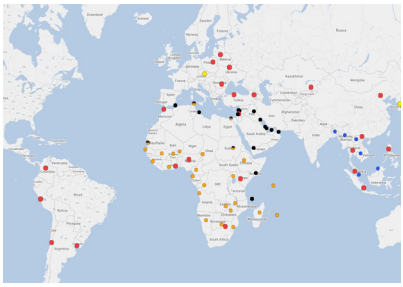


NRC provides on the job training for regulatory staff from Romania in 2018. Credit: U.S. NRC.

As the assistance program gained an independent footing, it established a program of global ambitions tailored to unique regional needs. In 2010, the RSRP expanded to Latin America and, in 2012, to Africa. While the RSRP is a mostly bilateral initiative, it also developed regionally focused programs for Africa, as well as for Russian- and Spanish-speaking nations. Under the RSRP, the NRC supported development of RASOD (Radiation Sources Database) to assist regulatory bodies for registration and control of sources, and a follow-up database, the Advanced Regulatory Information System (ARIS), that is used in about 20 countries. In 2013, Congress reaffirmed the importance of the source assistance program by appropriating about $12 million to fund work in over 35 countries in the former Soviet Union, Latin America, Africa, and the Middle East.[63]

The International Regulatory Development Partnership

In 2008, the NRC replicated its success in the RSRP by establishing the International Regulatory Development Partnership (IRDP) dedicated to assisting countries to build strong national nuclear power regulatory programs. The IRDP focuses on training in the fundamentals of reactor safety and regulation, industry codes and standards, and quality assurance. The IRDP initially served Armenia, Kazakhstan, and Vietnam and expanded to over a dozen nations in the Middle East, CEE, Africa, and Asia. In the wake of the 2011 Fukushima accident, interest in new power reactors declined, and the international assistance program shifted to support research reactors and small modular reactors. In 2009, the NRC established the Partnership for Uranium Recovery Regulation (PURR) to provide similar regulatory assistance in uranium recovery, licensing processes, environmental reviews, and decommissioning. All of these assistance programs are conducted in close coordination with comparable IAEA programs.



Map of countries the NRC has supported or is supporting in the area of commercial nuclear reactors through the International Regulatory Development Partnership (IRDP).

In 2019, the NRC's International Regulatory Development Partnership conducted a workshop on reactor licensing and regulation for the Arab Network of Nuclear Regulators in Jordan. Credit: U.S. NRC.

International Assistance

In the 1970s, the Commission worried that an expansive international assistance program might appear as too promotional for a regulatory agency or could blemish the NRC's reputation if it helped partner nations that later made flawed regulatory decisions. The subsequent

development of international safety conventions, standards, and codes has alleviated this concern by allowing the NRC to work closely with the IAEA to assist nations in reaching common international benchmarks for safety and security. For example, the NRC helped secure over $4 million from the U.S. Nonproliferation and Disarmament Fund to launch regional IAEA-administered projects in the Middle East and North Africa and Latin America and the Caribbean. The NRC supports the IAEA program to enhance regional regulatory oversight of radioactive materials to meet the IAEA's Code of Conduct on the Safety and Security of Radioactive Sources. The IAEA program has expanded to assist African countries and has received coordinated support from assistance programs in France, the United Kingdom, and Canada.[64] In the years after the 9/11 attacks, NRC international assistance has benefitted from a national and international consensus on the importance of helping other nations reduce the probability that nuclear materials might be lost or diverted and agreement on the standards that should guide national regulators.

NRC provides technical support for the evaluation of cyclotrons for regulatory staff in Paraguay in 2017. Credit: U.S. NRC.

NRC Assistance and U.S. Foreign Relations

Executive Branch agencies such as the Departments of State, Energy, and Commerce have all communicated that the NRC's international assistance programs' emphasis on robust safety and security regulatory practices complements U.S. competitiveness, by fostering best practices in the development of foreign nuclear regulatory frameworks.[65] In 2020, for example, then-Secretary of Energy Dan Brouillette signed a new Intergovernmental Agreement with his Polish counterpart on a 30-year commitment to assist in the development of a Polish civil nuclear power program and diversify its energy options away from coal while reducing its reliance on single "coercive suppliers" of energy. As part of the agreement, the NRC conducted workshops with the Polish nuclear regulator on new reactor licensing and inspection. Polish regulators also worked with the IAEA's Regulatory Cooperation Forum and the NRC to simulate reviewing a license application.[66]

In the last decade, the versatility of the NRC assistance program has proven invaluable to U.S. strategic interests. The international marketplace for nuclear technology has regained some of its geopolitical import reminiscent of its early Cold War competition. In recent years, U.S. adversaries have promoted nuclear technology sales to deepen political and strategic relationships with nations important to U.S. interests. U.S. government officials have warned that these great power competitors pursue these alliances with permissive financing terms and questionable safety, security, and nonproliferation standards and regulatory practices.[67] In April 2021, the State Department announced an initiative to promote regulatory practices compatible with the latest U.S. reactor technology, the Foundational Infrastructure for Responsible Use of Small Modular Reactor (SMR) Technology (FIRST) program. FIRST seeks to deepen strategic ties with nations that wish to develop the regulatory capacity to deploy small-modular nuclear power plants. FIRST seeks to collaborate with partner nations to promote safeguards, security, and safety standards consistent with the IAEA's Milestones Approach. The program recognizes that FIRST benefits U.S. nuclear SMR suppliers that maintain high quality standards. The NRC program has supported FIRST by conducting virtual workshops with interested nations.[68]

The NRC assistance program maintains its traditional commitments to nations that operate U.S.-designed reactors. Since the 1970s, the NRC technical staff has provided bilateral assistance to the National Commission of Nuclear Safety and Safeguards of Mexico (CNSNS) in its oversight of the operation of its Laguna Verde Nuclear Power Plant. Recently, the NRC helped Mexican regulators prepare for the review of the plant's license renewal application with training in aging management audits and inviting CNSNS staff to view NRC safety audits at the Surry Nuclear Power Plant in Virginia. The NRC has also provided training and resources to CNSNS for source security, new reactor construction licensing, and participation in meetings on the Convention on Nuclear Safety. Similarly, the NRC has supported counterparts in Argentina, Brazil, China, Romania and South Africa with nuclear power plant aging management and license renewal.

With the arrival of the COVID-19 pandemic in early 2020, the NRC international assistance program adapted to the restrictions and

opportunities of a virtual environment. In-person courses were converted to online training modules that operate from a virtual platform. The NRC has developed training videos, conducted virtual bilateral meetings, and presented three virtual training courses on cyclotron licensing, basic radiation safety, and medical linear accelerator (LINAC) licensing. The NRC has concentrated on existing nuclear power programs that are in the process of modernization, such as Romania, or considering the development of nuclear power programs in the near future (e.g. Poland and Nigeria).

This work has involved NRC staff and consultants. In the last twenty years, NRC international assistance has recaptured some the original intent of the Atoms for Peace program. The NRC international assistance program provides global benefits by helping countries build robust regulatory capabilities to ensure the safe and secure use of nuclear applications.

IRDP conducts a virtual meeting with Polish regulators in April 2021 on the management of construction permit documentation. Credit: U.S. NRC.

Conclusion

In 2014, the Commission issued an International Policy Statement asserting that international assistance activities ". . . are expended without expectation that the information exchange will provide immediate benefits to an NRC program area. However, such exchanges are viewed by the Commission, the larger U.S. Government, and the international community as invaluable tools for establishing multilateral coalitions, enhancing global nuclear safety and security, and strengthening regulatory programs for nuclear power plants, research reactors and radioactive materials."[69] Assistance generously offered irrespective of a nation's technological choices has enhanced the NRC's global standing, improved international communication, and helped ensure safety and security in the uses of civilian nuclear energy world-wide.

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