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UNLEASHING THE NUCLEAR WATCHDOG

STRENGTHENING AND REFORM OF THE IAEA

TREVOR FINDLAY

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Trevor Findlay

Canadian Centre for Treaty Compliance
CARLETON UNIVERSITY

CIGI's Strengthening and Reform of the International Atomic Energy Agency project is conducted in partnership with the Canadian Centre for Treaty Compliance (CCTC) at the Norman Paterson School of International Affairs, Carleton University, Ottawa. The project is directed by Trevor Findlay, Senior Fellow at CIGI and Director of the CCTC.

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57 Erb Street West
Waterloo, Ontario N2L 6C2
Canada
tel +1 519 885 2444 fax + 1 519 885 5450
www.cigionline.org

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES AND FIGURES

About the Author

A CIGI Senior Fellow since 2006, Trevor Findlay is a professor at the Norman Paterson School of International Affairs (NPSIA) at Carleton University in Ottawa, Canada, where he holds the William and Jeanie Barton Chair in International Affairs. He is also director of the Canadian Centre for Treaty Compliance (CCTC) at NPSIA. Professor Findlay has a B.A. (Hons.) degree from the University of Melbourne and an M.A. and Ph.D. in international relations from the Australian National University (ANU) in Canberra.

He spent 13 years in the Australian Foreign Service, with postings in Tokyo, Mexico City and Geneva. He has served as an Australian delegate to the Conference on Disarmament in Geneva, the UN General Assembly and UN Disarmament Commission in New York. His academic career began at the ANU as Foreign Affairs Fellow, Senior Fellow and acting head of the Peace Research Centre. Professor Findlay was subsequently inaugural project leader on peacekeeping and regional security at the Stockholm International Peace Research Institute, followed by seven years as Executive Director of the Verification Research, Training and Information Centre (VERTIC) in London, United Kingdom. He chaired the Independent Commission on the Verifiability of the Comprehensive Nuclear Test Ban Treaty in 2002, was involved in "second track" diplomacy efforts in 2003-2004 to design a verification system for an Israel-Palestine peace accord and was adviser to the Canadian chair of the UN Expert Panel on Verification in 2006.

Professor Findlay's expertise covers disarmament, arms control and non-proliferation in respect of nuclear, chemical and biological weapons; monitoring, verification and compliance; as well as peace operations and regional security. He is the author of seven books, including *Nuclear Dynamite: The Peaceful Nuclear Explosions Fiasco* (Sydney: Brassey's Australia, 1990); *Cambodia: The Legacy and Lessons of UNTAC* (Oxford: Oxford University Press, 1995); *The Use of Force in UN Peace Operations* (Oxford: Oxford University Press, 2002); and, most recently, *Nuclear Energy and Global Governance: Ensuring Safety, Security and Non-proliferation* (London: Routledge, 2011). He is the author of numerous book chapters, including five on conflict prevention, management and resolution for the *SIPRI Yearbook*, as well as reports, journal articles and conference papers. He has been the editor of nine books, including five editions of the *Verification Yearbook*, and editor of *Pacific Research*, *Trust & Verify* and *Compliance Chronicles*. In 2003, he produced a *Handbook on Verification and Compliance* for the UN Institute for Disarmament Research for use by UN diplomats. Professor Findlay has testified to, and provided research input for, the Blix Commission on Weapons of Mass Destruction and the Australia-Japan International Commission on Nuclear Nonproliferation and Disarmament, and provided testimony for the Australian and Canadian Parliaments and the NATO Assembly. He is an experienced media performer, with television appearances on the Australian, British and Canadian broadcasting corporations (ABC, BBC and CBC) among others, to his credit, in addition to commenting on the radio and in the print media in Australia, Canada and the United Kingdom.

For CIGI, Professor Findlay has managed two major projects on global nuclear governance, both in cooperation with the CCTC. The first, from 2006 to 2010, was a multidisciplinary project called Nuclear Energy Futures: Implications and Options for Global Governance. The project produced a four-volume report by Professor Findlay, covering the future of nuclear energy to 2030; and the implications for nuclear safety, nuclear security and nuclear non-proliferation respectively, as well as an Overview and Action Plan. This current report on strengthening and reform of the IAEA is a follow-on study. Professor Findlay's previous work on global governance includes reports on enhancing the Organization for the Prohibition of Chemical Weapons and on lessons to be learned from the UN peace operations in Cambodia and Somalia, and from the UN Special Commission and the UN Monitoring, Verification and Inspection Commission in Iraq.

Professor Findlay is currently a Visiting Research Fellow with the International Security Program and the Project on Managing the Atom at the Belfer Center for Science and International Affairs at the Harvard Kennedy School, Harvard University.

PREFACE

The idea for this study arose from a report on the *Future of Nuclear Energy to 2030: Implications for Global Governance* published by CIGI in early 2010. The report was a product of the Nuclear Energy Futures (NEF) Project, a joint undertaking by CIGI and the Canadian Centre for Treaty Compliance (CCTC) at the Norman Paterson School of International Affairs (NPSIA) at Carleton University in Ottawa. It had become increasingly obvious as that study proceeded, if it was not before, that the International Atomic Energy Agency (IAEA) was not only currently the paramount institution for global nuclear governance, but that its role was likely to become even more critical as the twenty-first century unfolded. Notable drivers were the growing interest in nuclear energy on the part of many countries as a response to global warming and demands for energy security; the perceived threat of nuclear terrorism post-9/11; continuing concerns about nuclear safety, which have since been regrettably vindicated by the disaster at Fukushima in March 2011; and the seemingly endless non-compliance cases of Iran, North Korea and Syria.

It seemed eminently sensible to follow up the NEF project with one that examined the singular role of the IAEA in its entirety — governance, organizational and management issues as well as substantive ones — and that drew together and re-examined the recommendations made about the Agency in the NEF report. This report is the outcome of the two-and-a-half year research project on "Strengthening and Reform of the IAEA" conducted by the CCTC and CIGI. The project aimed to carry out a "root and branch" study of the Agency to examine its current strengths and weaknesses and make recommendations for bolstering and, if necessary, reforming it. There have been previous enquiries into the Agency by the US Government Accounting Office and Congressional Research Service, along with internal audits and management consultancy reports, as well as an Independent Commission of Eminent Persons into the role of the IAEA to 2020 and Beyond (the so-called 20/20 Commission), which reported in May 2008. However, this is the first independent academic study of the Agency. It is needed not just in the light of accumulating challenges to the IAEA's future and the increasing demands made on it by its member states, but because the Agency itself is demanding more support and resources. At a time of financial stringencies, many of the countries that traditionally have offered such support seek proper justification for any increases.

The project began with a scoping workshop held at CIGI in October 2010 that clarified the key issues to be pursued. Primary and secondary documentation has been widely surveyed. Interviews and consultations have been held with current and former diplomats and government officials, academics, non-governmental representatives and officials of international organizations. I am particularly grateful to officials of the IAEA, the Australian Safeguards and Nonproliferation Office, the Canadian Department of Foreign Affairs and International Trade, the Canadian Nuclear Safety Commission, the Pacific Northwest National Laboratory, the UK's Department of Energy and Climate Change, the US Government Accounting Office, the US Congressional Research Service, the US State Department, the US Department of Energy, the World Institute for Nuclear Security (WINS) and various diplomatic missions in Vienna. While they will remain anonymous, their assistance and advice were critical in producing this report. Official reviewers Mark Gwozdecky and Jim Keeley provided invaluable insights and suggestions. The draft report's initial findings were also considered at a Managing the Atom seminar at Harvard University on October 25, 2011, at an International Security Program seminar at Harvard on March 29, 2012, and at a public event and private consultations organized by the University of California's Institute on Global Conflict and Cooperation in Washington, DC, on February 24, 2012. I am grateful to Larry Scheinman and Joseph Pilat for their helpful observations at that meeting. Former IAEA Deputy Director General David Waller was generous with his time and insights in reviewing the management and finance sections of the draft.

In addition, I am grateful to CIGI for its generous financial and material support for the project and the helpfulness of its staff, in particular Tom Bernes, Anne Blayney, Max Brem, Steve Cross, Brandon Currie, David Dewitt, Kevin Dias, Jennifer Goyder, Fred Kuntz and Andrew Schrumm. I was especially fortunate to have Carol Bonnett as my editor. I am also indebted to the Managing the Atom Project and the International Security Program at the Belfer Center at the Harvard Kennedy School, Harvard University. Not only did they provide early advice on the project, but also awarded me a joint fellowship at the Belfer Center during my sabbatical from Carleton University to enable me to complete this report surrounded by my peers who care passionately about the same issues. I am especially indebted to Graham Allison, Robert Brown, Matt Bunn, Olli Heinonen, Marty Malin, Steve Miller and Yvonne Yew.

At Carleton University I am especially grateful for the administrative and research assistance of my former students Derek de Jong and Justin Alger, administrator and researcher at the CCTC, both of whom have gone on to bigger and better things. At Harvard I was fortunate to obtain the assistance of Alexander Ely, a student at the Fletcher School at Tufts University, as a research assistant. In addition, former Carleton student Aaron Shull helped me with a comparative study of the IAEA and the International Civil Aviation Organization.

In addition, the following individuals advised, encouraged, assisted or otherwise supported me in this project: Tim Andrews,

Andrew Barlow, John Barrett, Michael Brown, Jim Casterton, Shaun Caza, John Carlson, Jim Casterton, Jill Cooley, Elizabeth Dowdsewell, Tom Ellacott, Janice Fitchett, Mark Fitzpatrick, Sarah Fraser, Anthony Hinton, Roger Howsley, Bates Gill, Ingrid Hall, Mark Hibbs, Peter Jenkins, Peter Kaiser, Kurt Kessler, Joanna Kidd, Martine Letts, Jacqueline Littlewood, Susan Lynch, Bill McCarthy, Gerry McGuire, Fred Morris, Chantal de Jong Oudraat, Bill Paton, Andreas Persbo, John Philipps, Jean du Preez, Tariq Rauf, Christopher Reberger, Jenni Rissanen, Greg Schulte, Mark Shaffer, Henry Sokolski, Elena Sokova, Sharon Squassoni, Christopher Toomey, Tibor Tóth, Ken Wagstaff, David Waller, Mark Whitney, Tracy Wilson and Terry Wood. I apologize to anyone I have forgotten.

Finally, I acknowledge standing on the shoulders of giants. The late David Fischer and Larry Scheinman are the authors of the two masterworks on the IAEA and without them I would have been wandering in the wilderness. I hope I have not ill-used them.

Naturally, despite the luxuriant help and advice I received, the opinions and recommendations contained herein are my responsibility alone.

Trevor Findlay
April 2012

UN Vienna International Centre. (UN Photo by Mark Garten)

EXECUTIVE SUMMARY

The International Atomic Energy Agency (IAEA) is the principal multilateral organization mandated by the international community to deal with nuclear issues. Established in 1957 and based in Vienna, it is essentially the nucleus around which all other parts of the global nuclear governance system revolve. This report, based on more than two years of research, interviews and consultations, concludes that the IAEA is:

- irreplaceable — like the United Nations itself, if it did not exist it would have to be invented;
- considering its capabilities, size and budget, a veritable bargain for international peace and security;
- effective and efficient — mostly;
- in need of both strengthening and reform — in certain key respects; and
- deserving of increased funding from member states and greater support from all stakeholders.

The IAEA has attributes and roles that cannot be matched by other organizations, groups of states or individual states, no matter how powerful or influential:

- It is a standing, multilateral organization with near universal membership and a science and technology orientation.
- Its nuclear safeguards system and associated verification activity is unparalleled.
- Its legitimacy and credibility allow it to oversee the formulation and dissemination of global nuclear non-proliferation, safety and security norms.
- Its role in fostering improved nuclear safety is well established and set to grow following the 2011 Fukushima disaster.
- Its work in the sensitive area of nuclear security is expanding and has great long-term potential, given the

likely ephemeral nature of some other international arrangements.

- Its independence from the nuclear industry allows it to be a disinterested promoter of nuclear energy for states where it is appropriate, affordable and subject to the achievement of necessary milestones.
- Its assistance to developing countries in the peaceful uses of nuclear energy is an essential component of the nuclear non-proliferation bargain.
- Its impartiality permits it to be a facilitator and, in some cases, an active driver of treaty implementation across a wide spectrum of nuclear issues.
- It plays a unique role in fostering a truly international nuclear community.

The organization has, in many respects, evolved deftly over the past 55 years, shedding unrealizable visions, seizing new opportunities and handling with aplomb several international crises into which it has been drawn. Its Secretariat's technical competence and professionalism is highly regarded. The IAEA is widely viewed as one of the most effective and efficient in the UN family of organizations. Zero real budgetary growth has forced the Agency to stay relatively compact and to continuously seek efficiencies.

The research for this report confirms that, nonetheless, while the IAEA does not need a dramatic overhaul, it does need strengthening and reform — in particular respects. The Agency has not taken advantage of all the authorities and capacities that it has, and it sometimes has failed to seize opportunities staring it in the face. Like all venerable organizations it also suffers from a number of long-standing "legacy" issues that need fixing.

For the IAEA's key programs — safeguards, safety, security and promotion of the peaceful uses of nuclear energy — the following conclusions were reached:

- nuclear safeguards have been considerably strengthened in recent years, but current efforts to find new approaches and technologies and to change the old safeguards culture need to be intensified;
- the Agency's role in nuclear safety is being strengthened post-Fukushima, but remains hobbled by member states' reluctance to commit to mandatory measures and provide adequate resources;
- the Agency's emergency response capabilities produced mixed outcomes during the Fukushima disaster and need careful reconsideration and extra resources;
- the nuclear security tasks accorded to the Agency by member states, although growing, tend to be modest and supportive of external efforts: the Secretariat needs to rapidly equip itself for this new area of work and member states need to resource this activity properly; and
- Technical Cooperation (TC) has long been undermanaged, under-resourced and overexploited by some member states; current reform efforts need to be sustained and extended.

Among the Agency's governance, managerial and administrative challenges are the following:

- the governing bodies have seen a dissipation of the "spirit of Vienna," resulting from sharpened political divisions between developed and developing countries — especially over compliance, verification and peaceful uses;
- the Agency's leadership has struggled to find the correct balance between taking the initiative as an "independent" organization and necessary acquiescence to member states' disparate and evolving demands — especially over non-compliance controversies;
- the Secretariat has faced some long-standing management issues, including: insufficient strategic planning; a flat management structure; inconsistent practices and quality control across departments; programmatic stovepiping; a proliferation of programs, projects and mechanisms; and inadequate personnel policies;
- as a result of zero real budgetary growth, the Agency's infrastructure, technology (including IT) and human resources have deteriorated and the adoption of modern management tools has been delayed (although steps are underway to address all of these);
- intra-agency barriers to communication, transparency and information sharing have persisted; and
- the Agency has not communicated successfully with all of its stakeholders, including the media, the general public, the nuclear industry, the international development community and even member states.

In addition to meeting current expectations, the Agency also needs to prepare itself for future challenges:

- given that verification is never 100 percent effective and is likely to be needed in perpetuity, and that certain states may still risk non-compliance, safeguards and other verification capacities need constant enhancement, especially for detecting undeclared activities;
- the Agency's roles in nuclear safety and security by their very nature will likewise always be works-in-progress;
- new special verification mandates may arise or be resurrected at any time, as in the cases of Iran, North Korea and Syria;
- the Agency will likely be offered a role in verifying steps towards global nuclear disarmament, beginning with a Fissionable Material Cut-Off Treaty and assistance with bilateral US/Russia cuts; and

- despite Fukushima, runaway climate change may induce rapid demand for nuclear electricity and an upsurge in demand for the Agency's advisory and assistance services.

Reform and strengthening is already occurring in a number of areas of the IAEA's operations. Unless otherwise indicated, this report endorses such efforts and, in many instances, recommends that they be pursued with even greater vigour. This report also identifies a raft of other possibilities, both major and minor, for improving the Agency's performance in the short to medium term. In most cases, however, change will only be achievable if all the players work in tandem. Several proposals would require amending the Statute or involve decisions by the Board of Governors (BoG) and or the General Conference (GC). There should be no illusions about the difficulty of achieving agreement on these. Although there are some reforms that the Director General (DG) and Secretariat can themselves initiate, in almost every case they will require at least the tacit support of member states. In many instances a balance will need to be struck between cost, feasibility and member states' sensitivities about intrusiveness, confidentiality and sovereignty. The newly emerging powers, those with greater political and financial clout and growing nuclear energy industries, such as Brazil, China, India and South Korea, should play a greater role in governing, managing, supporting and funding the Agency than they have in the past. A full list of these recommended proposals can be found on page 126.

While this report puts no dollar or euro figure on what is required, it is an inescapable conclusion that the Agency is significantly underfunded, considering its responsibilities and the expectations increasingly being placed on it. Fukushima has reinforced this conclusion. In almost all cases, strengthening and reform will require additional resources, especially funding that can usually only be provided by the member states holding the purse strings. Hence, the importance of a grand budgetary bargain along the lines proposed in this report.

One of the Agency's major challenges is to meet the expectations of its member states and other nuclear stakeholders, which are often unrealistic. By being more transparent, open and honest about the functions it can and cannot fulfill, and being more diligent in providing convincing justification for funding increases in particular programs, the Agency may be able to attenuate this problem. This is especially important at a time of global financial stringencies. The Agency should also beware of raising unrealizable expectations itself: it should not describe itself as the hub, central point or focal point of a particular realm unless it is truly able to fulfill such functions.

Since it is states that established the IAEA, pay for it, provide its personnel and other resources, and grant it the necessary privileges and immunities, it is they that ultimately control its destiny. It is true that, like many organizations, the Agency has assumed an independent identity and presence in international affairs that no one member state can gainsay, and that in some circumstances it has some room for independent manoeuvre, especially by balancing the interests of various member states. It can in some respects strengthen and reform itself. But ultimately, it is constrained by the strong preferences of its membership as a whole or those of key, active member states. It is therefore to the member states that we must look to trigger and sustain lasting strengthening and reform — and thus unleash the nuclear watchdog.

IAEA fact-finding mission assesses Fukushima nuclear power plant. (UN Photo by Greg Webb)

INTRODUCTION

The events at Japan's Fukushima Daiichi reactors in March 2011, when an earthquake and tsunami led to explosions, core meltdowns and widespread releases of radioactivity, were reminders of the truism that a nuclear accident somewhere is a nuclear accident everywhere. Images of Japanese nuclear workers struggling to understand and control the situation, reports of disagreement between the authorities and the utility company over actions to be taken, uncertainty about the safety of food and water, and a dearth of reliable and consistent information about the unfolding disaster demonstrated the need for the involvement of a higher authority than the Japanese government. The effects of the catastrophe beyond Japanese shores reinforced this conclusion. Residents of Vancouver, Canada, rushed to buy iodine pills to counteract radioactive fallout, countries with nationals in Tokyo and elsewhere in Japan worried about their evacuation, while neighbours China, Russia and South Korea all felt powerless to intervene with assistance. The need for global governance could not have been more obvious.

Yet there was a global governance body available to help — the IAEA. Located in Vienna, it has decades of experience and highly regarded technical expertise in nuclear safety. The IAEA was supposed to provide the international community with information and advice, assist the stricken country where it could, act as a clearinghouse to coordinate worldwide assistance, and begin to determine what had gone wrong and what lessons might be learned. The general public, member states, civil society and the media all expected the self-described "independent intergovernmental, science and technology-based organization in the United Nations system that serves as the global focal point for nuclear cooperation" (UN, 2011c: 15) to leap into action.

It did not. For 24 hours the IAEA said nothing publicly. It apparently saw no need for an early public assessment of the situation, an urgent meeting of member states or even a press conference. The Agency's new Director General (DG) Yukiya Amano, who happens to be Japanese, initially saw no need to make a statement or to go to Tokyo to assess the situation first-hand. The Agency held its first press briefing four days after the disaster struck, but relied solely on

information from the Japanese government, whether accurate or not. It saw no need to interpret or supplement that information and no need to explain the reactor technology involved or the techniques being used to control the situation. Despite the Agency's vast experience and expertise acquired over 55 years, and much activity behind the scenes, it added no public value in the earliest days of the Fukushima crisis. With the Japanese government downplaying the severity of the situation and the US government warning of reactor meltdowns, the Agency should have seized the opportunity to provide continuous, independent, fact-based analysis of the situation, and assume the public profile and leadership expected of it. At an eventual briefing session for IAEA missions, a frustrated US ambassador blurted out that what the global public really wanted from the IAEA was the answer to basic questions such as: Is it safe to eat this lettuce leaf from Fukushima?

The IAEA was faltering in its public reaction to the biggest nuclear crisis since Chernobyl. Other players leapt into the void, threatening the Agency's status and future prospects. French President Nicolas Sarkozy called an "informal ministerial" conference on nuclear safety in Paris, while UN Secretary-General Ban Ki-moon called for a high-level meeting to be held at the next UN General Assembly in New York.

Under intense pressure from the United States and other Western countries, the IAEA eventually did leap into action and regained the lead in responding to the crisis, but not before its image had been tarnished. The Fukushima case once again illustrated the weaknesses of global nuclear governance and the need for strengthening and reform. While the Agency is only part of that governance regime it is the most important component — a nucleus around which all the other atoms spin.

Established in 1957, the IAEA is one of the most respected members of the UN family of organizations. Partly because it is not a specialized UN agency, like the UN Food and Agriculture Organization (FAO) or the UN Educational and Scientific Organization (UNESCO), it has been regarded as better governed, less prone to gratuitous politicization and more technically oriented. Jointly awarded the Nobel Peace Prize in 2005 with its then DG Mohamed ElBaradei, the IAEA is constantly invoked as being vital in tackling one of the greatest continuing threats to international security — nuclear weapons proliferation, whether by states or so-called non-state actors. The IAEA plays an indispensible role in verifying compliance with the 1968 Nuclear Non-Proliferation Treaty (NPT) and a number of nuclear weapon-free zone treaties.[1] Its role in setting global standards for nuclear safety and security and in providing multilateral technical assistance to developing states in the nuclear field is unique. The Agency's international profile has soared through its involvement in the nuclear weapon proliferation cases of Iraq, North Korea and Iran. In addition, it played a significant, although little heralded, role in verifying and facilitating Iraq's forced divestiture of its nuclear weapons potential after the 1990 Gulf War and in verifying South Africa's nuclear disarmament.

The Agency has reacted well to nuclear crises in the past, taking advantage of each window of opportunity to improve its performance and enhance its role in global nuclear governance. After the discovery that Iraq had come close to a nuclear weapons capability, the IAEA strengthened its verification system, known as nuclear safeguards, not least through its adoption of the Model Additional Protocol (AP). The 1986 Chernobyl accident paradoxically revived the Agency's fortunes in the area of nuclear safety, leading to a "fundamental expansion of its safety programme" (IAEA, 2008h: 3) and new responsibilities, notably through the negotiation of new international conventions. Following the disclosure of the A.Q. Khan nuclear smuggling network, the Agency expanded its role in detecting and tracking such operations. Since the terrorist attacks of 9/11, the IAEA is also seen as playing a vital role in strengthening nuclear security to help prevent nuclear terrorism. It has finally begun to realize one of its original missions as a nuclear fuel bank, in order to provide some assurance of nuclear fuel supply to member states lacking their own fuel production capabilities.

The IAEA's membership has continued to expand, from the 54 states that attended the First General Conference in 1958 to 144 members in 2011 (see Annex 1). Its regular budget has increased during the same period, from US$3.5 million[2] (Fischer, 1997: 497) — with an additional $124,000 in voluntary contributions — to an estimated €321 million[3] regular budget, with an additional €34 million ($119 million) in estimated extra-budgetary contributions (IAEA, 2010a). The Technical Cooperation (TC) Programme,[4] through which the Agency assists developing states in the peaceful uses of nuclear technology, has grown from $414,000 in 1958 (Fischer, 1997: 497) to a target of €108.6 million in 2012 (IAEA, 2011b: iii). The total number of professional and support staff has likewise grown from 424 in 1958 (Fischer, 1997: 497-498) to 2,338 in 2010 (IAEA, 2011d). In the IAEA's first three years of existence, it applied safeguards solely to three tons of natural uranium supplied by Canada to Japan (Fischer, 1997: 82), but by 2010 it was applying safeguards in 175 states (plus Taiwan), applicable to 949 facilities. It conducted 2,122 on-site inspections in 2010 (IAEA, 2011d).

The IAEA is regarded as one of the most efficient and well-managed UN agencies. The 2004 UN High-Level Panel on Threats, Challenges and Change declared that the IAEA "stands out as an extraordinary bargain" (UN, 2004b: 18). In 2006, the US Office of Management and Budget (OMB) gave it a virtually unprecedented rating of 100 percent in terms of value-for-money (OMB, 2006). The Commission of Eminent Persons said, in 2008, the IAEA "deserved the unstinting

1 These are: Latin America and the Caribbean (1967 Treaty of Tlatelolco); South Pacific (1985 Treaty of Rarotonga); Southeast Asia (1995 Treaty of Bangkok); Africa (1996 Treaty of Pelindaba); and Central Asia (2006 Treaty of Semipalatinsk).

2 Unless otherwise indicated, all dollar amounts in this report will be US dollars.

3 The IAEA uses the euro as its budgetary currency. For its accounting purposes, it treats the euro and US dollar as being at parity.

4 The original term, "technical assistance," was dropped in 1982 as it implied dependency, while cooperation denotes mutuality.

support of the international community" and spoke of its "well-earned reputation for objectivity and technical competence" (IAEA, 2008h).[5]

In spite of this well-deserved reputation and its apparently starry prospects, the Agency remains relatively undernourished, its powers significantly hedged and its technical achievements often overshadowed by political controversy. This evidently prized body has, for instance, been largely unable to break free of the zero real growth (ZRG) budgeting imposed on all UN agencies from the mid-1980s onwards (ZRG means no growth beyond inflation). As a result, the Agency has not been provided with the latest technologies and adequate human resources. Moreover, despite considerable strengthening, its enhanced nuclear safeguards system is only partly mandatory. Notwithstanding the increasing influence of its recommended standards and guides, its safety and security powers remain entirely non-binding. Although the Agency's long-term response to the Fukushima disaster remains to be seen, its role in nuclear safety and security continues to be hamstrung by states' sensitivity about sovereignty and secrecy, and by its own lack of capacity. Many states have shown a surprising degree of ambiguity towards supporting the organization both politically and financially. The politicization of its governing bodies has increased alarmingly in recent years, crimping its potential.

Most alarming of all, the Agency has failed, by its own means, to detect serious non-compliance by Iraq, Iran and Libya with their safeguards agreements and, by extension, with the NPT (although it was the first to detect North Korea's non-compliance). Iran's non-compliance had gone undetected for over two decades. Most recently, the Agency missed Syria's attempt to construct a nuclear reactor with North Korean assistance. Despite significant improvements to the nuclear safeguards regime, there is substantial room for improvement, especially in detecting undeclared materials, facilities and activities.[6]

While the Agency was a key player in the case of Iraq, it was initially marginalized in the Libyan case by the United States and the United Kingdom, and has been outranked in the North Korean case by regional initiatives, including the episodic Six-Party Talks after 2003 and the 2004 Agreed Framework. After years of crucial Agency involvement with Iran, that country is closer to acquiring nuclear weapons than ever before. Iran's behaviour — resisting resolution of the non-compliance case against it and creating mischief in unrelated areas — is souring the atmosphere in the Agency's BoG and making the Secretariat anxious about any initiative that might incur the ire of the Iranian delegation.

This report, therefore, comes at a crucial time for the Agency. In addition to the challenges already alluded to, it also faces significant future unknowns. Among these is the extent to which increased interest in the use of nuclear energy for electricity generation will translate into significant deployment of new nuclear reactors, especially in states that have not previously had them. The renewed interest in nuclear energy since 2000 has never truly been global and was never a renaissance (Findlay, 2010a). It has, in any case, been dampened by the Fukushima accident. Yet, there may still be a steady stream of states seeking advice and assistance as they consider nuclear energy as a way of curbing their greenhouse gas emissions to combat climate change. In addition, some states are ploughing ahead with their existing nuclear energy programs regardless, most spectacularly China. Expansion plans may include new fuel cycle facilities, some of which will require safeguarding (if they are in non-nuclear weapon states). New generation reactor types will require new approaches, ideally incorporating "safeguards by design."[7] Equally important is the possibility that the IAEA may become involved in verifying aspects of nuclear disarmament — verification of a Fissile Material Cut-off Treaty (FMCT) will be one of the first steps. Despite considerable groundwork being laid for the Agency to verify stocks of excess weapons materials declared by Russia and the United States, beyond that a clear role for the IAEA in nuclear disarmament has not yet emerged.

In another respect, this report could not be more timely. After 12 years under the leadership of Egyptian Mohamed ElBaradei — a strong and, at times, controversial figure — the Agency has had a new DG since December 2009. Yukiya Amano has moved to put his own stamp on the organization, notably with respect to the appointment of key personnel and budgetary matters. Individual parts of the Agency, the Safeguards Department for one, are already planning or in the midst of their own transformations. The Agency is, therefore, a moving target for reform proposals. This report seeks to be as current as possible within the limitations of the publication process.

The success of the IAEA depends on a collaborative relationship between its member states and the international civil service that runs the Agency on their behalf. In apportioning blame for the Agency's failures or praise for its triumphs, this report will seek to clearly identify who is responsible and who must initiate the necessary reforms. The IAEA's Secretariat, led by the DG, is bound by the Agency's mandate embodied in the IAEA Statute (as amended), by the wishes of its member states and by the resources given to it. Contrary to popular misconception, the Secretariat has no enforcement or

5 The 2006 Blix Commission, on the other hand, was surprisingly coy about the value of the IAEA (see Weapons of Mass Destruction Commission [WMDC], 2006), as was the 2009 Independent Commission on Nuclear Non-proliferation and Disarmament [ICNND] (see ICNND, 2009).

6 All of the major non-compliance cases — Iran, Iraq, Libya, North Korea and Syria — at least partially took this route, rather than through the diversion of declared materials and facilities to weapons purposes. Iraq did reprocess a small amount of plutonium in violation of safeguards (Office of Technological Assessment [OTA], 1995: 14). While North Korea's plutonium-based infraction involved an attempted diversion from a declared facility, its uranium-based alternative has involved the construction of an undeclared enrichment facility.

7 This refers to the notion that in planning and designing new nuclear facilities, the requirements of safeguards are taken into account at the earliest possible stage and incorporated into the design. Retrofitting safeguards, especially when surveillance cameras are involved, can be expensive and awkward.

policing powers. It cannot, for instance, be blamed for not forcing Iran back into compliance with its international obligations.

Given that the Agency was established by states, is governed by them and interacts with them on a daily basis — on issues ranging from non-controversial technical cooperation projects to highly charged non-compliance controversies — it cannot, for the purposes of analysis, be divorced from its political context in order to be clinically dissected. Politics is a fact of life in all international organizations and cannot be wished away. The General Conference and the BoG of the IAEA are inherently political, while the Secretariat is meant to be politically neutral and technical in its focus. Some of the most abiding and difficult challenges facing the IAEA, notably the gulf between the developed and developing world, are political. These are not amenable to institutional or other narrow fixes, but would only flow from broader changes in international relations. In fact, the most radical reforms that might be suggested for the Agency will be simply unachievable due to the political opposition they would incur. An attempt to impose a mandatory safety peer review of nuclear reactor operations on all states is a current example, and another would be to make the AP compulsory.

Nonetheless, this report will consider not just what the IAEA's member states should do to strengthen and reform the Agency, but also what might be done by the DG and Secretariat on their own initiative, notwithstanding the well-known political and financial constraints within which they must operate (not all of which are permanently immutable). There has been a long-standing view among outside experts, some member states and within parts of the Secretariat itself that the organization has not used all the powers and resources available to it and that unleashing these could contribute significantly to improving its performance.

By the same token, the Agency cannot be treated as if it were a commercially oriented corporation run in accordance with strict business principles, in part because of the role that politics plays in the Agency's governance, but also because its revenue stream is determined only in part by how effective and efficient it is. Although concerned with effectiveness and efficiency, this report does not attempt to emulate a management consultant study, but rather will focus on the intersection of politics, governance, treaty implementation and organization. Where management reforms are suggested, this will usually take the form of a recommendation for further expert studies.

Given the extent and complexity of the Agency's activities, this report cannot hope to cover all of them in detail, but will focus on the most significant and on those most amenable to practical steps for strengthening and reform. It is unfortunate that this report is being published at a time when the global economic circumstances make large additional financial contributions to the Agency unlikely — much less a permanent breakout from zero-growth budgeting. The financial implications of any proposed reforms will, therefore, be carefully weighed.

The report first considers the origins of the IAEA, its Statute and its mandate. After considering the Agency's governance and leadership, the bulk of the report is devoted to the major IAEA programs, with an emphasis on the Agency's performance in the past decade. It starts with nuclear safety, given its prominence since Fukushima;[8] followed by nuclear security, due to its links with nuclear safety; then discusses nuclear safeguards, including verification more broadly; and ends with the promotion of the peaceful uses of nuclear energy, including the Technical Cooperation Programme. Recommendations for strengthening and reform are advanced for each of these areas. This is followed by consideration of the organizational means through which the Agency seeks to fulfill its objectives, ranging from management and administration, including human resources; technology; and, finally, finance and budget. Suggestions for strengthening and reform are also made in each of these areas. The report concludes with a summation of the Agency's overall performance in the past decade; some overarching, Agency-wide recommendations for strengthening and reform; and some suggestions on how political support for the Agency might be engendered.

8 The only area of nuclear safety not considered in this report is the Agency's involvement with the nuclear liability regimes. These regimes are so convoluted and in need of drastic reform that they warrant their own separate study.

US President Dwight D. Eisenhower addressing the UN General Assembly in 1953, where he proposed the creation of a new UN atomic energy agency. (UN Photo #64292)

PART ONE: ORIGINS AND MANDATE

The concept of the IAEA arose from a proposal by US President Dwight D. Eisenhower in 1953. Eisenhower, seeking a way out of the growing nuclear arms race between the United States and the Soviet Union, seized on the "Atoms for Peace" concept. In a now-famous speech to the United Nations General Assembly, he suggested an "International Atomic Energy Agency" that would control a certain amount of nuclear material and use it to facilitate the spread of peaceful nuclear technology — under a "safeguards" system yet to be developed. Far from confronting the possibility, foreseen by many even then, that peaceful nuclear technology might be misused to acquire nuclear weapons, the proposal seemed to assume that recipients would be too "dazzled" by American nuclear largesse to consider the weapons option. It was apparently also assumed that nuclear technology for both weapons and for peaceful uses was likely, in any event, to be too complex for other states to master. Moreover, a shortage of uranium, along with a Western-dominated uranium cartel, would make most countries beholden to the United States for both nuclear materials and technology, giving it leverage over states that might be tempted to acquire the bomb. Although the vague concept of "safeguards" seemed inadequate for the non-proliferation task, this inconvenient fact tended to be overlooked both by "Atoms for Peace" advocates and potential recipients. In this willful ignorance the seeds of the current challenges facing the global governance of nuclear energy can be seen. Nonetheless, Eisenhower's "Atoms for Peace" speech was widely perceived as a master stroke of US diplomacy: even the Soviets were disinclined to harshly criticize it.

In 1955, the United States further impressed the world with its display of peaceful nuclear technology at the first Conference on the Peaceful Uses of Atomic Energy, a US initiative held in Geneva under UN auspices. The conference greatly increased international interest in the peaceful uses of nuclear energy. The following month the United States hastily convened a Safeguard Conference[1] in Geneva to

1 Officially called the Meeting of Six Governments (Hewlett and Holl, 1989: 628).

consider "technical safeguards" that emphasized the physical security of fissionable material and detection of "procedural violations." The meeting proved to be "something of a disaster": the United States had no idea how nuclear safeguards were going to work effectively to prevent weapons proliferation, while the Soviets were content to nitpick at others' suggestions (Hewlett and Holl, 1989: 314).

Nonetheless, the United States was determined to proceed. It initiated negotiations on a statute for the agency, hand-picked the initial participating countries, tabled the working draft and shaped the talks to the very end, shepherding it through several negotiating sessions and, finally, through a UN conference in September 1956. The Agency was thus largely a creature of the United States' making. The Statute was opened for signature on October 26, 1956 and entered into force on July 29, 1957. In the meantime, a preparatory commission met to set up the Agency, lay out its initial programs and choose the location of its headquarters (Vienna) and its first DG.

THE STATUTE

The IAEA Statute reflects the mix of idealism and realpolitik that motivated its founders, in particular the Americans. The document obliges the Agency to "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world," while ensuring, "so far as it is able," that this does not "further any military purpose" (IAEA, 1956: Art. II). Balancing these two goals has presented the Agency with its greatest challenge. To this end, the Agency was authorized to "establish and administer safeguards," (IAEA, 1956: Art. III.5) including for "special fissionable and other materials," notably plutonium and highly enriched uranium, which could be used to make nuclear weapons. When eventually implemented, this system would constitute an unprecedented surrender of sovereign authority over a key emerging technology. Safeguards would involve not just nuclear accounting, but on-site inspections by an international inspectorate. The Statute makes no mention of an Agency role in nuclear disarmament, but it does permit it to "apply safeguards, at the request of the parties, to any bilateral or multilateral arrangements, or at the request of a State party, to any of that State's activities in the field of atomic energy" (IAEA, 1956: Art. III.A.5).

In promoting nuclear energy, the Agency was enjoined to act as an "intermediary" between member states, if requested, for materials, services, equipment and facilities, as well as itself "making provision" for supplying such items (IAEA, 1956: Art. III. 6). "Due consideration" was to be given to the needs of the "under-developed areas of the world," as they were then known. The Agency was also to foster scientific and technical exchanges and encourage training, in addition to establishing safety standards for the "protection of health and minimization of danger to life and property" (but apparently not the environment), and apply these to its own undertakings and, on request, to its member states' activities. Nuclear security was not mentioned. The Agency could also acquire its own facilities, plant and equipment. The Statute goes into some detail about the operation, under IAEA auspices, of a nuclear "pool," into which states would deposit special and source materials that other states could draw on as required (IAEA, 1956: Art. IX).

Like UN specialized agencies, the IAEA reports to the UN's Economic and Social Council, but since the Agency's mandate touches on matters of international peace and security, it also reports to and receives recommendations from the UN General Assembly (debated in the first instance in its First Committee). More importantly, the IAEA reports to and may receive instructions from the UN Security Council, notably in cases of non-compliance with safeguards agreements. As an independent statutory body, the Agency has a cooperation agreement with the United Nations (IAEA, 1963).

ENTER THE NPT AND IAEA: BOON AND COMPLICATION

The arrival of the NPT, negotiated in the late 1960s, more than a decade after the IAEA was established, was both a boon and a complication for the Agency. In giving the IAEA the task of verifying compliance by the non-nuclear weapon states (NNWS) with their non-proliferation obligations under the NPT, it provided the organization with a new raison d'être. Ultimately, this led to the Agency acquiring the primacy in nuclear governance that it enjoys today; however, the NPT also introduced enduring structural complications that have affected the IAEA's operation and crimped its potential to this day.

The NPT affirmed, in international law, the underlying, somewhat wishful premise of "Atoms for Peace" — in return for assistance in the peaceful uses of nuclear technology, the NNWS would not seek to acquire nuclear weapons. Their obligations would be verified by the IAEA through compulsory, comprehensive nuclear safeguards. Violators would suffer consequences in case of non-compliance, ultimately through referral to the UN Security Council and possible enforcement action under Chapter VII of the UN Charter (UN, 1945). The NPT also prohibited the existing five nuclear weapon states (NWS) — Britain, China, France, the Soviet Union and the United States — from assisting any NNWS to acquire nuclear weapons. In Article VI it called for "negotiations in good faith" by all NPT parties (but by implication especially the NWS) to achieve nuclear disarmament.

Over the decades, the NPT has proven its worth, helping avoid a world of 20-plus NWS, the number that had been predicted in the 1960s, most memorably by US President John F. Kennedy. The Treaty has gradually attracted parties (hereafter referred to as states parties),[2] to the point where today it is almost universal — albeit with three significant remaining "holdouts": India, Israel and Pakistan. In 1995 it was extended indefinitely. Despite periodic warnings of its imminent demise, notably due to the serious non-compliance

2 States that sign and ratify a treaty are known as states party to the treaty. States that only sign, but do not ratify, are known as signatories. Some treaties permit international organizations to become parties, in which case the parties are known collectively as the contracting parties.

cases of Iraq, North Korea, Libya and Iran, the NPT has endured, essentially because of the security benefits it confers on its members (although these seem to be under constant debate).

A major complication, not least for the IAEA, was the NPT's arbitrary and apparent permanent perpetuation of two classes of states: those that had detonated a nuclear device before January 1, 1967, which also happened to be the five permanent members of the UN Security Council (the P5), and those that had not. Since the NPT was drafted initially by the three major nuclear powers of the day, the United States, the United Kingdom and the Soviet Union, which subsequently resisted major changes to the text by the NNWS, its nuclear disarmament provisions are weak and vague. While the Treaty has led the IAEA to impose ever-increasing verification burdens on NNWS, the NWS have remained, to all intents and purposes, unburdened. Although they have made "voluntary offers" to put some of their facilities under similar scrutiny, in practice, the IAEA has had neither the resources nor the inclination, given its other priorities, to implement such essentially token gestures. With no NPT Secretariat or verification body established to monitor and verify compliance with the parts of the Treaty not covered by IAEA safeguards, this role has fallen to the states parties to the Treaty, assembled every five years at NPT Review Conferences. Successive conferences have failed to create substantial momentum towards nuclear disarmament, much less instituting measures to monitor compliance with such a process.

Over the years, the lack of progress towards complete nuclear disarmament (despite significant cuts in nuclear weapons since the Cold War, which have occurred largely for other reasons) and the lack of accountability of the NWS in respect of their Article VI obligations, has increasingly put the NPT under strain, with implications for the smooth functioning of the IAEA. Attempts to constantly strengthen and improve nuclear safeguards draw opposition, not just because of concerns over costs, intrusiveness and commercial competitiveness, but also because the NNWS feel that the NWS have not lived up to their side of the NPT's "grand bargain" and that the Treaty's burdens are being borne disproportionately. This view is shared not just by the radical non-aligned states, but by all of the Western states, which foreswore the nuclear weapons option on the basis that all states would eventually do so. The developing countries also believe the advanced nuclear states have not lived up to their obligation under Article IV of the NPT to share the benefits of the peaceful uses of nuclear technology, including through the IAEA. Such disputes over implementation of the NPT are one reason for the increasing politicization of the IAEA's governance processes in recent years.

These complications in nuclear governance have been exacerbated by the way the NPT assigned verification of compliance by the NNWS to an existing agency — the IAEA, which has a structure, membership and organizational culture not explicitly designed for that purpose. This is in contrast to the Organisation for the Prohibition of Chemical Weapons (OPCW), which was purpose-built for the 1993 Chemical Weapons Convention (CWC) and the Comprehensive Nuclear-Test Ban Treaty Organization (CTBTO), which is being established specifically for the 1999 Comprehensive Nuclear-Test Ban Treaty (CTBT). The members of each of these organizations are all states parties to the Treaty that they are committed to implementing and verifying.

This is not the case with the NPT and IAEA. Member states that are not party to the NPT or only grudgingly accept it have consistently sought to "problemize" the NPT/IAEA link. As BoG members, non-NPT parties have, remarkably, been able to sit in judgment on compliance with a treaty to which they themselves are not party. Most glaringly, India has, from the outset, not only decried and declined to join the NPT, but has sought to undermine it from within the IAEA (as elsewhere). Latecomers to the NPT like Argentina, Brazil, Cuba, France, South Africa and North Korea have also been troublesome at various stages. Over time, as NPT membership has approached universality, the problem has abated, but India, Pakistan and Israel remain non-NPT members of the IAEA. The link with the NPT has also permitted parties and non-parties alike to drag Article VI disarmament issues into an organization that is not mandated to deal with them.

To understand the origins of the IAEA, its Statute and its subsequent tethering to the NPT, is to appreciate both the opportunities and constraints that affect the current operation of the Agency. One of the greatest impacts that historical legacy currently has on the Agency is visible in the way it is governed and led. It is to those aspects that this report now turns.

IAEA BoG meeting to discuss North Korea. (IAEA Photo by Dean Calma)

PART TWO: GOVERNANCE AND LEADERSHIP

The IAEA Statute established what has become the standard structure for multilateral disarmament and arms control organizations. Its governance comprises a General Conference (GC) of all states parties and a limited membership executive body called the Board of Governors (BoG). The Agency also has a permanent international civil service called the Secretariat, which includes a permanent safeguards inspectorate. The Secretariat is headed by an elected Director General (DG). Akin to the Secretary-General of the United Nations, this position is a combination of chief civil servant and diplomatic and political representative of the organization.

THE GENERAL CONFERENCE

The IAEA Statute gives the GC relatively limited powers. It "may discuss any questions" and "make recommendations," but it is not "the highest policy making body of the IAEA" as the Agency is prone to describing it. The GC approves new member states, may suspend a member state for persistent violations of the Statute, approves agreements between the IAEA and other organizations, and appoints the DG — but it only does so on the recommendation of the BoG. The GC meets just once a year, typically in September, to consider and approve the Agency's program and budget put to it by the Board, and to decide on other matters brought before it by the Board, the DG, or member states. The Conference's resolutions, which are adopted by majority vote, tend to be habitually repeated year after year, like those of the UN General Assembly. GC debates are often dry and technical, but can be highly political and occasionally theatrical. Since the developing countries are now in a majority, their views have a strong influence on the tone and content of the GC's resolutions. The conference serves a useful purpose as a sounding board for new and potentially contentious ideas, allows activist member states to let off steam and gives every member state an opportunity to air its views and policies. The BoG, for its part, often ignores or attenuates the impact of the GC's resolutions.

THE BOARD OF GOVERNORS

The BoG is by far the most important player in IAEA governance. This differentiates the IAEA from most UN specialized agencies, where power is vested in the periodic conferences of member states. Power over the IAEA is concentrated in the hands of the Board both by statutory design and evolved practice. In contrast to the GC, the Statute describes its role extremely broadly as being "to carry out the functions of the Agency in accordance with [the] Statute, subject to its responsibilities to the General Conference…" (IAEA, 1956: Art. VI.F.). It currently holds regular sessions six times a year, but may also meet in emergency sessions if necessary. It considers all major questions, including applications for membership and the Agency's work program. The Board approves all safeguards agreements, safety and security standards and major projects. It also agrees on the annual budget before its submission to the GC. The BoG's most significant statutory power is the right to declare a state in violation of its safeguards obligations, and to report it to the UN Security Council (IAEA, 1956: Art. XII. C).

One of the statutory origins of the Board's power is the virtually permanent membership accorded to a select group of states. While there are similar arrangements in other parts of the UN system to ensure that the most powerful states, especially the P5, are always in charge, the IAEA case is particularly striking. It came about through a "complex but ingenious formula" proposed by India during the Statute negotiations (Fischer, 1997: 39). This gave the Board 12 "quasi-permanent" members, considered to be most advanced in the nuclear field, either globally or regionally (IAEA, 1956: Art. IV.A.1). Since the BoG decides which member states are the most advanced, and since it is awkward for any state to be deselected (although this has happened, albeit rarely), the group essentially nominates itself year after year. Unsurprisingly, those originally designated were mostly the countries that had drafted the Statute.

Although the group has varied marginally over the years, the core countries have remained: Canada, China (designated after it joined the Agency in 1964), France, Russia (formerly the Soviet Union), the United Kingdom and the United States as the most globally advanced, along with Argentina or Brazil for Latin America; South Africa for Africa and the Middle East; Japan for the Far East; India for South Asia; and Australia for Southeast Asia and the Pacific, plus one other seat alternatively allocated to another European state.[1] Most are Western countries. All five permanent members of the UN Security Council are represented, each having the power to second-guess Board referral of a non-compliance case to the Council by vetoing it in that forum. Possessed of continuous Board experience and collective memory on which to draw, the quasi-permanent members have wielded disproportionate influence over IAEA governance.

While this arrangement has produced a remarkably stable "nuclear club" at the helm of the Agency, there is a sense that the foxes were let permanently into the chicken coop. Five of the quasi-permanent BoG members — eventually the five "official" NWS designated by the NPT — already had or soon acquired nuclear weapons. An additional four original members — Australia, Brazil, India and South Africa — harboured secret nuclear weapon ambitions at various points. India and South Africa succeeded. Moreover, Brazil, India and South Africa saw the Agency as useful in providing them with peaceful technical assistance that might both help them acquire nuclear weapons and mask their real ambitions. In addition to having the ability to consistently defend their own interests on the Board, all of members of the club, at various times, have sought to minimize the impact of nuclear safeguards on themselves by influencing the design of the rules applicable to them. This explains, in part, why safeguards have never been as effective as they might have been. Although not included in this group, Iran and Pakistan had similar aspirations and sought regular election to the Board for two-year temporary terms.[2]

In addition to the quasi-permanent members, the Statute provided (originally) for another 10 members to be elected on a regional basis by the GC to serve two-year terms (elections take place every two years). In 1963, the number of members was increased to 12 to supplement the representation of Africa and the Middle East, bringing total BoG membership to 25. In 1973, the "Italian amendment" (so-called as Italy unsuccessfully sought to use it to gain a permanent seat) (Fischer, 1997: 90–92) further increased the number of elected seats to 22, bringing the total BoG membership to 34.[3] This reform forever ended the "blocking third," which the West and its allies commanded within the Board (budgetary questions require a two-thirds majority vote, as do any "substantive" questions that a majority of members consider require such a vote). The BoG has thus been admirably more representative of the global community than the governing bodies of other agencies in the UN family (such as the Bretton Woods institutions), due to the inclusion of Brazil, India and South Africa from the outset, and by continually increasing representation of the new IAEA members from the developing world.

Nonetheless, there have been continuing demands for even greater representation of developing states. In 1999, the GC adopted an amendment to the Statute that would expand BoG membership to 40, including 18 "designated" members (IAEA, 1999a). This would further increase representation from two regional groups: Africa and the Middle East; and South Asia. It would also replace the "ten most advanced nations" clause with a clear, mandatory regional breakdown. Despite being adopted more than a decade ago, the amendment has failed to obtain the requisite ratification by two-

1 The formula assigned an alternating seat to Belgium and Portugal and another to Czechoslovakia and Poland as major providers of "source" material. Finally, one seat was allocated to a significant supplier of technical assistance, with the understanding that this would rotate among four Scandinavian countries — Denmark, Finland, Norway and Sweden. (Fischer, 1997: 40).

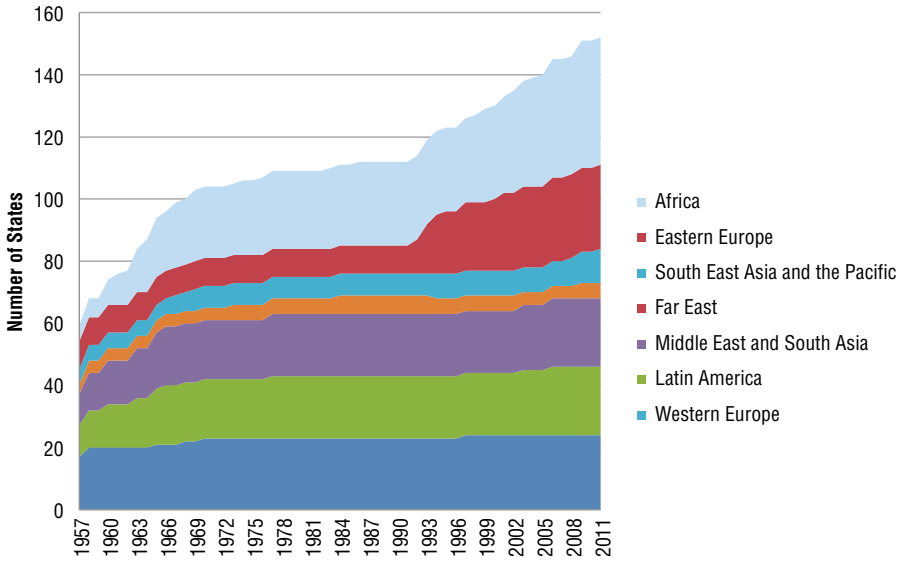
2 Iran has been elected six times, Pakistan 17.

3 Thirty-five when China joined.

thirds of the membership to permit it to enter into force. Presumably this is because key BoG members are concerned about diluting their own power, but also due to concerns that expanding the size of the BoG will render it even more dysfunctional than it is.[4] The continuous expansion of the Conference on Disarmament in Geneva has done nothing to improve its effectiveness and may have rendered it permanently incapacitated. Before the amendment comes into force, it also requires adoption by the BoG and confirmation by the GC of a list that allocates each IAEA member state to one of the eight areas identified in Article VI.A.1 of the Statute, a process that has proved problematic in the past.

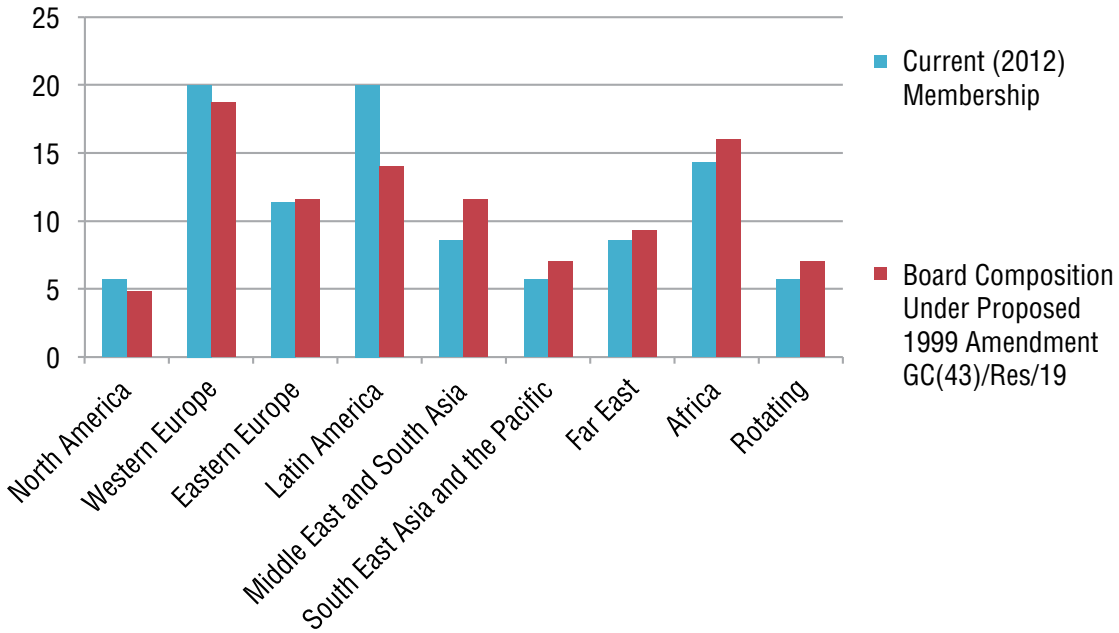
4 As of September 2011, it had only 52 ratifications, notable absences being Australia, China, India, Russia and the United States.

Figure 1: IAEA Membership by Group per Year (1957–2011)



Source: Adapted from "Member States of the IAEA."

Figure 2: Percentage of IAEA Board of Governors Seats by Region



Source: Adapted from IAEA data available at: www.iaea.org/About/Policy/Board/; and IAEA (1999a).

There has, in recent years, been a creeping sense that at least some of the "quasi-permanent" members, notably Belgium, Czechoslovakia (now represented by the Czech Republic) and Portugal, are no longer leading countries in nuclear energy. Even Australia, which remains one of the world's largest exporters of uranium, is being challenged by the rise of Indonesia and Vietnam as regional states with more sophisticated nuclear enterprises. It is hard to see how the system can be readily changed, however, since it requires the acquiescence of the members that are to be demoted, along with the agreement of the Board itself. This has been done in the past, but only with great difficulty.

"POLITICIZATION" OF IAEA GOVERNANCE

One of the issues often raised about the IAEA's governing bodies is the alleged increasing politicization that infects their operation, slows decision making and wastes enormous amounts of delegation time and energy. While politics is to be expected in such political bodies, the implication of such accusations is that extraneous political issues, irrelevant to the IAEA, are being used to disrupt proceedings or even that legitimate political issues are being disproportionately introduced into matters that should be considered mostly or entirely on their technical or other merits. Yet, whether one considers an issue is being politicized or not will often depend on whether one agrees with the particular political line being pursued. This makes objective judgments about "inappropriate" levels of politicization difficult to make.

In the earliest days of the Agency, a "spirit of Vienna" was reputed to guide the proceedings of the then-smaller governing bodies, helping them reach consensus through compromise and accommodation. Voting was frowned upon and valiant efforts were made to avoid it. Proceedings were, naturally, dominated by the original drafters of the Statute. Some developing countries left their seats empty due to a lack of diplomatic representation in Vienna, ceding the running of the Agency to its most powerful members. No wonder they reminisce about the spirit of Vienna.

In the Board, the "spirit" was even more sanctified. The very term "governors" suggested that representatives were appointed in their personal capacities to watch over the welfare of an apolitical, technical organization. This was accentuated when nuclear scientists, who treated their jobs as technical rather than diplomatic or political (Fischer, 1997: 424) replaced some of the original diplomats, although in later years this trend reversed itself, as the authority of national nuclear energy organizations declined when early enthusiasm for nuclear energy waned.

Although it might have been expected that the IAEA — like all other international organizations at the time — would have been buffeted by the Cold War, in fact, once the Soviets realized in the early 1960s that the IAEA and its safeguards system might be valuable in preventing nuclear weapons proliferation, they and their Warsaw Pact allies helped to largely insulate the BoG and the Agency as a whole from such tribulations. Thereafter, the Western and Socialist blocs tended to see eye to eye on non-proliferation matters. Nonetheless, the era saw several highly political controversies erupt in the Agency's governing bodies, notably over Israel's attack on Iraq's Osirak nuclear research reactor in 1981, the Arab move to reject Israel's credentials in 1982 and the non-aligned attempt to hound the South African apartheid regime from membership in 1983. The yearning of IAEA "old timers" for the halcyon days of the Cold War should, therefore, be taken with a grain of salt.

Still, there is a widespread view that proceedings in the IAEA's governing bodies, the BoG in particular, have become more politicized in the past decade, signified by the increasing numbers of divisive votes taken. This is perceived as less problematic in the GC than in the Board, since it is the less powerful body and was clearly intended to be a debating forum. But even there the sharpening of political divisions is causing concern. Divisive votes have taken place in the GC in recent years on Israel's nuclear capabilities, safeguards in the Middle East, the European Union (EU)-sponsored resolution on safeguards and the Additional Protocol, as well as the annual nuclear security/terrorism resolution (Potter and Mukhatzhanova, 2012: 134). In 2011, the draft resolution on nuclear safeguards was held over when agreement could not be reached on the text.

Increasing politicization may be partly attributed to the more active role of the developing countries in Agency affairs. As Vienna has increasingly attracted UN specialized agencies, more countries have felt obliged to station permanent diplomatic staff in the city. While large delegations like those of the United States, Japan and Russia can afford to include technical experts, most countries rely solely on their diplomatic representatives, although presumably with technical advice from capitals on at least the most important issues. The smaller diplomatic missions, such as those from Africa, the Caribbean and the South Pacific, are hard-pressed to service all of the UN organizations to which they are accredited and for most, the IAEA ranks as a low priority compared with the development-oriented bodies which provide large amounts of aid and technical assistance. They struggle to cope with the flood of technical documentation emanating from the IAEA and are unable to attend all technical briefings and other specialized meetings. Focusing on political issues, which any delegation can command, is an easy option.

Along with these changes, the developing countries have collectively become more active in pursuing their interests at the IAEA through two main caucus groups now represented in Vienna. The first is the Group of 77 (G77), first formed in 1964 at the UN Conference on Trade and Development (UNCTAD). Its goal is to formulate group positions on economic development issues and press for their achievement in the UN system (Scheinman, 1987: 219). Long active at the IAEA, the G77 advocates for the biggest possible budget for technical assistance, including by linking it to increases in the verification budget. However, the G77 has traditionally steered away from political issues.

The Non-Aligned Movement (NAM) is a relative newcomer to the IAEA. Although it agreed as early as 1979 that it should have a "coordinated approach in the IAEA" to strengthen the role of developing countries, its Vienna chapter was only formed in 2003, at the instigation of Iran (Potter and Mukhatzhanova, 2012: 85). The NAM has a much broader political agenda than the G77 as "defender of the global South." In a formal division of labour, the NAM is supposed to speak as a group only on one of the IAEA's six major programs — verification and safeguards — while the G77 is supposed to address all of the rest, along with management and budget issues. (Under Iran's chairmanship of the G77 this division has frayed: in March 2011 the G77 spoke in the BoG on the issue of safeguards confidentiality.)

While the NAM is far from homogeneous, it is led by powerful, activist states. Singaporean diplomat Yvonne Yew identifies three key groups within the NAM: leaders (Algeria, Egypt, Malaysia and South Africa); spoilers (Cuba, Iran and Venezuela); and the rest. Unfortunately, she says, the spoilers have sought to run the NAM Vienna chapter on a "regressive platform based on divisiveness [and] virulent anti-Americanism" and have exploited the group in pursuit of their individual political ambitions (Yew, 2011: 9). The lack of a permanent NAM Secretariat allows the NAM chair a powerful opportunity to chart the group's direction, priorities and activities. Given that the vast majority of NAM members have no significant nuclear expertise or experience, advanced nuclear states in the NAM can wield disproportionate influence, sometimes with unfortunate outcomes. Potter and Mukhatzhanova recount the "strange case" of South Africa single-handedly derailing DG ElBaradei's proposal that the IAEA become active in the campaign to minimize the use of high (or highly) enriched uranium (HEU) (Potter and Mukhatzhanova, 2012: 127)

It is no coincidence that the NAM's appearance in Vienna coincided with the emergence of the Iranian non-compliance issue, which put the group from the outset at loggerheads with the United States and other Western states including Australia, Canada and the United Kingdom. According to Yew, the NAM Vienna chapter has served both as Iran's "diplomatic bulwark" and as a device for Iran to manipulate the "developing world's nuclear discourse" (Yew, 2011: 7). In the BoG, the NAM radicals have caused a more persistent breakdown of the spirit of Vienna, which had previously been able to reassert itself after fleeting lapses. The first BoG vote in years took place in 2005 over the issue of Iranian non-compliance and since then, votes have been taken several more times on the Iran issue, on Syria and even on seemingly innocuous Russian and IAEA fuel bank proposals.

It is likely that Iran's assumption of the NAM chair from 2012 to 2015 will further roil the BoG. Iran's positions are, however, so extreme and self-serving that it may end up alienating rather than co-opting the NAM Vienna chapter. Moreover, policy positions adopted collectively by the NAM are not necessarily reflected in the votes of individual NAM members, especially those keen to preserve their relationships with the Western group as a whole and the United States in particular. As Yew points out, only Venezuela voted against the first Iran resolution, in September 2005, while Colombia and Egypt supported the February 2006 resolution referring Iran to the UN Security Council. While Tanya Ogilvie-White characterizes this as a "sudden collapse of NAM unity" (2007: 457), others such as Potter and Mukhatzhanova, interpret it as simply revealing NAM differences previously masked by the usual efforts of the BoG to achieve consensus and avoid a vote (2012: 101–104). In fact, there is evidence that the introduction of the September 2005 resolution by France, Germany and the United Kingdom seemed to take the NAM by surprise, and forced them to vote before they could pursue the spirit of Vienna through consultations and compromise.

The West is also guilty of politicizing the IAEA, including the BoG, at various times. John Bolton, ambassador to the UN under the administration of George W. Bush, has admitted pushing for a quick Board referral of Iran to the UN Security Council, because "I just wanted to finish checking the boxes (first the IAEA and then the Council), either to get the real and substantive support we needed, or to show the 'multilateralists' that we had tried their route and were now going outside the UN system to do what we needed to do" (2007: 153). In September 2004, the Americans churlishly tried to amend the draft resolution on Iran to remove the standard reference to the Agency as "professional and impartial" in order to humiliate the DG (ElBaradei, 2011: 181). They also ran an active campaign behind the scenes to block ElBaradei's reappointment for a third term (including recording his telephone conversations), despite the overwhelming support he had from the IAEA membership (Bolton, 2007: 154). At times, the United States has even used the threat of withdrawal of funding (not just its voluntary contributions, but its legally binding assessed financial contribution to the regular budget) as a lever to get its own way. It did this openly in the incident over Israeli credentials in 1982, but also more recently. Nicholas Burns, US undersecretary of state for political affairs, reportedly told ElBaradei in pressing him to toe the US line on Iran, that "we pay 25 percent of your budget" (ElBaradei, 2011: 240, fn 19).

In an attempt to be more democratic and transparent, the BoG has opened up many of its meetings to include participation by any IAEA member state (Fischer, 1997: 429), a move that has both advantages and disadvantages. While it permits any state to air its views at the Board level on issues of particular concern, it also gives unwarranted "air time" to vexatious litigants. Iran, more than any other state, has exploited the opportunity to relentlessly defend itself, disrupt discussions it disapproves of (like strengthened verification measures) and deflect attention from its non-compliant activities.

THE DIRECTOR GENERAL

As chief administrative officer of the IAEA and head of the Secretariat, the DG has, under the Statute, significant authority and influence. As in the case of other UN and UN-related bodies, the position has, over time, attained much greater symbolic, diplomatic and political power than was envisaged when the Agency was being

conceptualized. This is especially so in the Agency's case because it was envisioned as being principally technical in nature. The dual-use nature of nuclear materials and technologies, along with the political and strategic ramifications of nuclear weapons proliferation, nuclear accidents and potential nuclear terrorism, have all propelled the DG's role into the realm of global and regional security and, thus, into critical issues of international politics. The DG and the Agency have, at times, found themselves at the heart of an international crisis, as in the case of the Security Council's consideration of whether to authorize a military operation against Iraq in 2003 and in the more recent Iranian non-compliance case. In these circumstances, how the Agency handles itself depends to a great extent on the personality of the DG. This is rendered even more critical by the absence of a true Deputy Director General (DDG) to share the political limelight and relieve the DG of certain duties during a crisis — rather, there are five DDGs, each responsible for their own substantive department.

The Agency has, fortunately, had a series of talented, respected and judicious DGs: American Sterling Cole (1957–1961); Swedes Sigvard Eklund (1961–1981) and Hans Blix (1981–1997); Egyptian Mohamed ElBaradei (1997–2009); and Japanese Yukiya Amano (2009–present). Their suitability for the position has not, however, always been obvious at the outset of their tenure, either because their qualifications seemed inadequate, their election was divisive or they were a compromise candidate — the least disliked of those standing. As in other international organizations, the DG is chosen through a political process where power, influence, financial considerations and regional balance all come into play. While all very different, successive DGs have often surprised the membership by deftly steering the Agency through dangerous political shoals while simultaneously enhancing its reputation.

The most controversial IAEA DG to date has been Mohamed ElBaradei, whose term lasted 12 years. He also faced the greatest challenges to the IAEA's authority and reputation, as the Agency was, as he put it: "at the intersection of technology and politics" (ElBaradei, 2011: 140). First, Elbaradei and the Agency were caught between Iraq's claims that it had divested itself of its nuclear capabilities under IAEA supervision after the Gulf War and US assertions that it was still hiding significant assets that would lead to an eventual "mushroom cloud" (Rice, 2011: 198). Second, he was placed in the even more gripping triangular vise between an Iran that sought to deny and then refute evidence of a longstanding, undeclared nuclear program; a Bush administration that sought to have Iran declared in non-compliance as quickly as possible and hauled before the UN Security Council; and the EU-3 (Germany, France and the United Kingdom), which sought a median position offering incentives and a diplomatic settlement. From 2006 onwards, ElBaradei was required to position the IAEA vis-à-vis the diplomatic activities of an even more powerful group of interlocutors on the Iran issue, the P5+1 (the permanent five members of the UN Security Council plus Germany).

The major criticisms of ElBaradei are fourfold: that he deliberately provoked the United States and the West; that he overstepped his mandate, especially after winning the Nobel Peace Prize, by "interfering" in international nuclear negotiations, advocating too openly for nuclear disarmament and straying into non-nuclear issues such as world poverty and hunger; that he downplayed the likelihood that states would violate their safeguards agreements and NPT obligations, most notably in the case of Iran and Syria; and, most seriously, that he was actually biased in favour of Iran and against the West. ElBaradei's allegedly soft handling of the Iran case was a particular point of contention between him and Western member states, especially the United States, but also Australia, Canada, France and the United Kingdom. Even the International Commission on Non-proliferation and Nuclear Disarmament (ICNND) accused the Agency, and by implication the DG, of delaying a finding of non-compliance by Iran for three years, due to "concern about the possible adverse consequences" (ICNND, 2009: 87). ElBaradei argues in his own defence that he was obliged as the DG to treat the Iranians (and later the Syrians) as "innocent until proven guilty." Due to the dual-use nature of many nuclear materials, technology and activities, he felt that he could and should not seek to judge a state's weapons intentions, but stick strictly to observable and demonstrable facts. It seems, though, that ElBaradei's motives arose less out of sympathy with Iran, Syria or other nuclear miscreants than out of an exaggerated fear, derived from his traumatizing experience of failing to prevent war in Iraq, that his decisions might result in armed conflict. He says quite openly in his memoirs that reaching a verdict that Iran had been conducting weaponization activities "had the potential to spell the difference between war and peace" (ElBaradei 2011: 289). This does not mean ElBaradei's patience with the Iranians was inexhaustible or that he would have ignored verified, conclusive evidence of an Iranian nuclear weapons program. In fact, he could be as blunt with his Iranian and Iraqi interlocutors as with the Americans and Israelis. His memoirs pointedly show his frustration with and at times incomprehension of Iranian behaviour, motives and intentions (ElBaradei, 2011: 120, 133, 208, 244, 246).

ElBaradei's greatest diplomatic failure may well have been his inability to convince the Americans that he was not overly solicitous towards the Iranians and, thus, complicit in their continuing defiance of the Board, the UN Security Council and the international community. His periodically intemperate behaviour towards the West and Israel did not help. Greg Schulte (2010) accuses ElBaradei of seeking to play a "political role" as a "nuclear negotiator" rather than a "watchdog," thereby undercutting the Agency's credibility. As an example, he offers the 2007 "work plan" that Elbaradei negotiated with Iran without consulting the BoG, which "removed pressure from Tehran." However, given its obsession with Iran and unwillingness to engage in direct talks with it, the United States was in part responsible for creating the diplomatic vacuum into which ElBaradei stepped. Moreover, ElBaradei retained the confidence of a majority of UN member states, including many in the Western group that found the US attempt to pressure and discredit him unwarranted and distasteful. It took great courage to stand up to the animus and political pressure directed at him by both the Iranians and the

Americans; unfortunately, his tenure did damage the reputation of the Agency in some quarters.

The current DG, Yukiya Amano, is almost the antithesis of ElBaradei — a careful Japanese diplomat experienced in multilateral nuclear affairs and with a pro-Western rather than pro-developing country inclination. Confidential documents released by WikiLeaks indicate, unsurprisingly, that having been strongly supported in his candidacy by the United States, Amano is keen to at least facilitate the realization of its policies (Borger, 2011). He has, perhaps not coincidentally, been more willing to press Iran and Syria to settle their outstanding non-compliance cases and has presented reports on them to the BoG that reflect a more critical, skeptical and investigative approach. The American mission to the IAEA reported after consultations with Amano following his election that "He distinguished his approach on Iran from that of ElBaradei; Amano sees the DG/IAEA as a neutral and impartial party to Iran's safeguards agreement rather than as 'an intermediary' and saw his primary role as implementing safeguards and UNSC [UN Security Council]/Board resolutions. He stressed that the IAEA could not replace the P5 [+] 1 political framework for dialogue with Iran, nor vice versa" (Borger, 2011).

DG Amano has moved relatively quickly to put his stamp on the organization, replacing a number of key personnel (including all of the DDGs), carrying out some organizational changes and, in some respects, modifying the emphasis and tone of the organization. He has expressed an interest in reform and in improved management and transparency. He is rather more cautious than ElBaradei in his dealings with civil society and the media, which can be seen as a useful corrective or a cause for concern. Worries have been expressed about Amano's close links to the Japanese mission in Vienna, something that could not be said of ElBaradei and the Egyptian mission. On budgetary issues Amano's ambitions have, so far, been modest, perhaps reflecting his own country's newly stringent financial approach as much as pressure from Western states for continuing zero growth. Amano has, nonetheless, also indicated an early appreciation for the need to cultivate the majority of the IAEA membership by, shortly after taking office, setting cancer treatment as an overarching priority for the Agency's technical cooperation and other peaceful uses activities in developing countries in 2010-2011.

In the view of many observers, Amano's greatest shortcoming to date has been his alleged tentative response to the Fukushima disaster. This may have been due to his relative inexperience as DG and his modest personality, but also the circumstances of his Japanese nationality. While being able to speak Japanese and communicate directly with the Japanese prime minister and other Japanese officials was an advantage, it was a disadvantage that he was a product of the same establishment that was seeking to cope with a disaster that was partly of their own making. Shortly after the Fukushima events began unfolding, some member states were reportedly openly canvassing the notion that Amano would be a one-term DG. Since March 2011, however, the Agency has, under his leadership, performed impressively in its post-disaster activities, redeeming somewhat the initial uncertain response. From a longer-term perspective, there have been other UN heads in the past who were assumed to be "placeholders" and took some time to find their feet, but ended up surprising us. Both Dag Hammarskjöld and Kofi Annan emerged as activist and successful UN Secretaries-General, despite initial indications that they would be neither.

CONCLUSIONS

Reforming its governance is the most intractable task facing the Agency. The Statute has been deliberately crafted by the states that negotiated it to protect their interests and is difficult to amend. Amendments must be approved by two-thirds of the members present and voting at a session of the GC, and then ratified by two-thirds of the members in accordance with their own constitutional processes (IAEA, 1956: Art. XVIII). Political divisions within the membership, notably the developed/developing country divide, render reforms that do not require a statutory amendment almost as difficult. Modest governance reforms that do not threaten the fundamental interests of any state or group of states, but improve the functioning of the Agency for the benefit of all, may be possible. However, it is not clear that anything fundamental can be done about the "politicization" of IAEA governance. The GC and the BoG are meant to be fora where politics is played out.

In the case of the GC, one reform idea is to convene biannually instead of annually. This would at least lessen the annual trauma of confrontations on repetitive issues that lead nowhere. But it would probably require a statutory amendment. More creative ideas have been proposed for smoothing the operation of the BoG. A former Canadian ambassador to the IAEA, Ingrid Hall, notes that as chair she pressed for more technical briefings from the Secretariat, which particularly helped new BoG members and smaller delegations that otherwise would have had difficulty preparing for meetings on complex issues. She also advocates more advance preparation for formal meetings on sensitive issues through informal consultations conducted by the chair. Hall notes the utility of the system of open-ended working groups chaired by vice-chairs on the budget and, occasionally, other items. Each vice-chair is selected by a regional group on a rotating basis, thereby avoiding the politicization that election by the Board as a whole would bring. Some of these bodies evolved into subcommittees of limited duration to wrestle with more difficult subjects before bringing them to the Board. This helped delegations get used to working with each other early, "before you hit the hard rocks of negotiation."[5]

Subgroups are not, however, necessarily any more effective than the Board as a whole. The Ad Hoc Committee on Strengthening Verification, which lasted from 2005 to 2007, was a dismal failure, essentially sabotaged by Iran when it suspected that it was the real target of the US-initiated group. The attempt to use restricted membership subcommittees to limit the influence of disruptive

5 Personal conversation with the author, Ottawa, July 14, 2011.

members is likely to be too transparent to be successful. Lawrence Scheinman, meanwhile, sees potential in an "Annecy Process,"[6] whereby governors meet outside Vienna for informal "retreats" to familiarize themselves with the issues and develop closer personal relationships than are possible in the "hothouse" of the Vienna International Centre. On the other hand, increasing the size and changing the regional composition of the BoG will do nothing to dampen the trend towards politicization and may make it worse.

Ultimately, the governance of the Agency can only be harmonious if all groupings of member states feel that their interests are being served. This requires compromise by the West on developing country sensitivities about peaceful uses, and a parallel willingness by the developing countries to appreciate the developed world's abiding concerns over nuclear non-proliferation, security and safety. There is an important role for the DG in facilitating such an outcome. To date, the West and Russia have often been able to "peel away" non-aligned members from their radical leadership with various inducements, but this can be counterproductive and may be unnecessary (Potter and Mukhatzhanova, 2012: 87).

The personal qualities and experience of DGs are crucial to the leadership of the Agency; however, considerations such as leadership and management skills are not decisive in the process of their selection. Member states will always try to influence the DG for their own purposes, sometimes illegitimately and ill-advisedly. DGs will always have their own personal styles and visions. One way to ensure that DGs do not become too pharaonic in their longevity would be to limit future terms to only two (the Statute contains no limit). There has been a trend towards successively shorter tenures anyway. The downsides to this idea are that the services of an excellent DG might be lost and elections of DGs are usually protracted and divisive. Another way to ensure an effective DG is to strengthen the Secretariat, which would provide him or her with the best possible scientific, technical, legal and political advice. Too much power should not be concentrated in the DG's office: alternative sources of advice must be allowed to flow to the DG. In addition, the Agency should strengthen its traditional links with the scientific and technical community, and enhance its relationship with policy institutes and civil society to ensure that the DG and other senior officials are exposed to a range of stakeholder views.

Finally, it may be useful to restructure the remarkably flat second tier of management of the Agency by appointing a single DDG who would act as the DG's representative when needed, relieve the DG of management responsibilities and allow him or her to concentrate on representing the Agency at the highest levels and dealing with member states (see IAEA organizational chart in Annex 2), especially during times of crisis. Having a "second in command" may help reduce the chance of overweening hubris taking over a leader, and would mean having a third management level for all of the other current DDGs and their respective functional departments. The United Nations benefited from such a reform in 1998, when Louise Fréchette was appointed the first Deputy Secretary-General.

6 This has been used somewhat successfully for delegations to NPT Review Conferences who meet informally in the French resort town of Annecy just outside Geneva.

RECOMMENDATIONS

- The GC should be convened biannually rather than annually to provide for political breathing space and allow for better preparations to be made.
- The existing proposal to expand the BoG should be dropped; the practice of self-perpetuating, quasi-permanent membership based on the level of advancement in "the technology of atomic energy" should be ended; all member states should have the opportunity of periodic election to the Board on an open regional basis.
- The use of technical briefings and subcommittees of the Board should be expanded for particularly controversial issues.
- An "Annecy" process of annual retreats for governors should be instituted.
- The Director Generalship should be limited to two consecutive terms.
- A single DDG should be appointed under the DG, while creating a third tier for the current DDGs.

Nuclear power plants (pressurized water reactors) under construction at Kudankulm, India. (IAEA Photo by Petr Pavlicek)

PART THREE: NUCLEAR SAFETY

Nuclear safety is one of the three "Ss" — safety, security and safeguards — that the IAEA sees as its critical missions. The Agency declares it has a "central role with respect to nuclear safety and security" as "set out in its Statute and enshrined in decisions and resolutions of its policymaking organs." Its role is "to provide a strong, sustainable and visible global nuclear safety and security framework" (UN, 2011c: 15-16).

The Agency's slow initial public response to Fukushima led many observers to question its effectiveness as the global "hub" of nuclear safety. Although the Agency did subsequently ramp up its involvement impressively, the disaster clearly revealed inadequacies in the international framework for responding to such events, including the role of the IAEA, and has provided some impetus for reform of various elements of the Agency's emergency preparedness and response capabilities. It also led to widespread calls for the Agency to: review its safety standards and guides; strengthen its role in ensuring member states consider seismic dangers in designing, siting and operating nuclear facilities; assist states in immediately conducting safety reviews (so-called "stress tests") of existing facilities; ramp up and reinforce the peer review system; and enhance the Agency's advice and assistance to states in the nuclear safety realm.

The first collective opportunity after Fukushima for states to urge the Agency to take the lead on nuclear safety improvements came at the Fifth Review Meeting for the Convention on Nuclear Safety, which happened to be convened in Vienna from April 4 to 14, a month after the disaster. This meeting was followed by an "informal ministerial seminar" held in Paris by the French presidency of the G8 and G20[1] on June 7, 2011, which endorsed an enhanced role for the IAEA, especially in peer review. Ideas generated at the seminar were forwarded to the Agency in a summary document (French Presidency

1 The G20 comprises Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, the United Kingdom, the United States and the European Union. The G8 comprises Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States.

of the G8-G20, 2011). Attended by 33 countries, it was organized in cooperation with the Technical Secretariat of the OECD/Nuclear Energy Agency (NEA). The IAEA itself convened what it billed, somewhat misleadingly, "the first high-level global gathering on nuclear safety since the Fukushima Daiichi accident in Japan" from June 20 to 24 in Vienna (Amano, 2011b). This Ministerial Conference on Nuclear Safety was intended to "make an initial assessment of the Fukushima accident, consider lessons that need to be learned, help launch a process to strengthen global nuclear safety and consider ways to further strengthen the response to nuclear accidents and emergencies" (IAEA, 2011cc). This conference refined some of the ideas from the Paris meeting; contributed further proposals to enhance nuclear safety, including strengthening the role of the IAEA (IAEA, 2011o); and produced a declaration requesting the DG to draft a nuclear safety action plan (IAEA, 2011i).

The Draft Action Plan on Nuclear Safety, duly prepared by the IAEA Secretariat in close consultation with member states, was agreed in September 2011 by the BoG and GC (IAEA, 2011j). As the document itself notes, it is too early to take into account all of the ramifications of Fukushima, including lessons learned, not least because the full scale and nature of the events are still being determined as the stabilization and cleanup processes proceed. Although the immediate crisis is over, the work of securing the reactors and the site, decommissioning the facility, and completing remedial and decommissioning work in the surrounding areas will take decades. The Agency thus intends that the action plan be revised as work continues and conclusions are drawn.

The DG immediately established a dedicated Nuclear Safety Action Team under the DDG who heads the Department of Nuclear Safety and Security to coordinate and assist in all activities for the prompt and full implementation of the Action Plan. An initial progress report by the Secretariat was presented to the BoG in November 2011 (IAEA, 2011q). An Action Plan "dashboard" on the IAEA website is intended to enable the general public to track progress (IAEA, 2012a).[2] Meanwhile, the Japanese government has announced it will host the Fukushima Ministerial Conference on Nuclear Safety, in co-sponsorship with the IAEA, from December 15 to 17, 2012, in Fukushima Prefecture. This will provide, the action plan notes, "an opportunity for learning further lessons and for enhancing transparency" (IAEA, 2011j: 1).

Describing the Agency's current activities in nuclear safety and making recommendations for strengthening and reform therefore confronts a fluid situation. The following takes into account, where possible, the impact to date of Fukushima, the implementation so far of the Action Plan (hereinafter referred to as the post-Fukushima Action Plan to distinguish it from other action plans in the field), and other reforms that have been mooted. While the Agency itself is making efforts to implement the elements of the plan that fall within its mandate, many other elements rely on member states taking action, with the Agency playing a supporting role, and only on request.

The post-Fukushima Action Plan does not explicitly increase the Agency's powers or bind states to any mandatory steps. It is likely, however, that the Fukushima disaster will, over time, lead to a gradual accretion of IAEA authority and influence in the nuclear safety field. All of the international gatherings that followed Fukushima strongly endorsed the Agency's central role and called for strengthening it. The growing awareness of the nexus between safety and security, where the Agency's involvement has already been expanding due to growing concerns about the threat of nuclear terrorism (see following section on nuclear security on page 45), is likely to compound this process. The Agency is, however, unlikely to be showered with massive infusions of additional funding or other resources for nuclear safety, and will certainly not see even a gradual accretion of authority that begins to match its role in nuclear safeguards.

THE IAEA'S ROLES IN NUCLEAR SAFETY

The first glimmer of a future international nuclear safety regime emerged in the 1950s during negotiations on the creation of the Agency (Gonzàles, 2002: 273). Amazingly, in retrospect, there appears to have been a tacit assumption by negotiators that the Agency would be mandated to impose safety standards on the civilian nuclear industry worldwide (Fischer, 1997: 461). The Preparatory Commission even foresaw the recruitment of safety inspectors and the development of "safety standards" (IAEA, 2008i: 1). Ultimately, though, as in many other areas, state prerogatives and industry views prevailed over radical innovations in international governance.

The IAEA Statute makes clear that the Agency's role in nuclear safety is limited to adopting and promulgating safety standards for voluntary adoption by states. It is authorized to impose mandatory safety requirements only on projects for which it provides assistance.[3] Curiously, though, the Statute also mandates the Agency to require the observance of its health and safety standards in any facility to which it has been asked to apply nuclear safeguards (IAEA, 1956: Art. XII.A.1 and 2). Safeguards inspectors were to be charged with determining compliance with such standards. This language was devised in an era when safeguards were voluntary. With the advent of the NPT, which required that safeguards be accepted by all NNWS parties, these requirements became a dead letter. Safeguards inspectors are not currently expected to report on health and safety

2 As of February 14, 2012, no progress was registered on the site.

3 The Statute describes the IAEA's nuclear safety role as being: "to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the UN and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operations as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangement, or, at the request of a State, to any of that "State's activities in the field of atomic energy" (Statute of the IAEA, 1957, Article III.A.6). Such measures were approved by the IAEA Board of Governors in March 1960.

matters, apart from those that may directly affect them in performing their duties.

Although there were numerous proposals in the 1960s to negotiate a legally binding international convention to govern the safety of civilian nuclear power facilities, states with major programs were disinclined to proceed, insisting that nuclear safety regulation and oversight was primarily a national responsibility. There was also continuing resistance to any extension of the IAEA's role in nuclear safety, with a clear preference for restricting it to the promulgation of non-binding safety standards (NEA/IAEA, 2006: 1). States instead turned their attention to creating nuclear accident liability regimes, set out in the Vienna and Paris Conventions, making them the first multilateral treaties governing any aspect of nuclear power generation (IAEA, 2003c: Part IV). Although these conventions were inadequate, they were at least an early recognition that serious nuclear accidents might have transboundary effects and that the nuclear industry was itself unable and unwilling to shoulder all of the financial risks.

The 1986 Chernobyl disaster was a "wake-up call" to the nuclear industry, national governments and the international community, demonstrating the cost of such transboundary effects and the truism that global nuclear safety requires a global, and not purely national, approach (Savchenko, 1995). It led, in record time, to the negotiation, under IAEA aegis and at IAEA urging, of two legally binding conventions — the 1986 Convention on Early Notification of a Nuclear Accident and the 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. These were intended to fill obvious shortcomings in international response mechanisms for a major nuclear accident. Chernobyl also provided the impetus for two conventions designed to help prevent nuclear accidents in the first place, although they took years to be realized: the 1994 Convention on Nuclear Safety and the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. In addition, the competing nuclear liability regimes were strengthened and linked (IAEA, 2003c: 108). After Chernobyl, numerous other initiatives were taken by industry, government and international bodies to strengthen the global governance of nuclear safety to the point where it may now be described as truly an international nuclear and radiation safety regime.

As in other areas of the IAEA's work, it is often difficult to tease out the various mandates under which the Agency operates in the nuclear safety field; it is a case of global governance growing by gradual osmosis and in the absence of any other obvious player able to take on the functions. The raft of new treaties after Chernobyl was an opportunity to broaden and deepen the IAEA's involvement in nuclear safety. In academic parlance, the Agency's critical role in nuclear safety is as "norm entrepreneur." As Fabrizio Nocera notes, the Agency has created a vast body of technical standards and recommendations on safety and protection regarding the use and transport of radioactive substances. These are the "common technical matrix" from which states may draw when framing their own national regulations, often assisted by the Agency itself (Nocera, 2005: 13). As an example, in 1991 the Agency was among the first to propagate the need for, and continual strengthening of, a "safety culture." The Agency also conducts safety advisory missions, manages peer reviews and provides a range of programs and services for member states. Some of these initiatives have been authorized by the GC or BoG, while others have been initiated by the Secretariat to meet the expectations of member states (Tirone, 2011). Others have arisen from, for instance, cooperation with the OECD/NEA or UN specialized agencies.

EMERGENCY PREPAREDNESS AND RESPONSE

The IAEA today claims to have acquired a "central role" in the international "framework" for dealing with nuclear incidents and accidents (IAEA, 2011l: 1). This claim flows, to some degree, from the two 1986 nuclear accident conventions, but much of it does not. It is a role that is currently under scrutiny following the Fukushima tragedy. The following details the elements of the system at the time of Fukushima and relates how they fared.

The IAEA's Role in Implementing the Nuclear Accident Conventions

The Convention on Early Notification of a Nuclear Accident (CENNA) and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (CACNARE) were both adopted by a special session of the IAEA General Conference in September 1986 and both entered into force a month later. As of November 2011, CENNA had 113 contracting parties and 69 signatories,[4] while CACNARE had 108 contracting parties and 68 signatories.[5] Among the contracting parties to both treaties are the World Health Organization (WHO), the World Meteorological Organization (WMO), the FAO and the European Atomic Energy Commission (EURATOM). Since the Fukushima event, only one additional state has acceded to CENNA and only two to CACNARE (IAEA, 2011q: 5).

CENNA applies when an accident releases or threatens to release radioactive material across international boundaries with consequences for the safety of another state. It covers accidents at all types of nuclear facilities.[6] In the event of an accident, a state party must notify and provide the "full details" to the IAEA and to any state that is or may be "physically affected." Each state party is obliged to ensure that the IAEA and other parties can identify the "competent national authorities" charged with implementing the state's obligations under the convention, and a "point of contact"

4 See www.iaea.org/Publications/Documents/Conventions/cenna_status.pdf.

5 See www.iaea.org/Publications/Documents/Conventions/cacnare_status.pdf.

6 Types of nuclear facilities are nuclear reactors, nuclear fuel cycle facilities, radioactive waste management facilities; this also includes nuclear fuels or radioactive waste in transport or storage and radioisotopes.

responsible for issuing and receiving notifications and information in the event of an accident.

Under the CACNARE, a state party, in the event of a nuclear accident, may call on any other state party or international organization for assistance. The recipient of such a request is obliged to promptly respond as to whether or not it can help, notify the IAEA of its capacity to assist and lay out the terms and conditions of its assistance. If requested by the stricken state, the IAEA may coordinate international assistance.

In addition to being the depositary for the two treaties, the IAEA also acts as their secretariat and has coordination, advisory and assistance roles in implementing them. Under CENNA, once the IAEA receives notification of a nuclear accident, it is required to inform all states and relevant international organizations. It is also obliged to maintain an up-to-date register of points of contact and competent authorities, as well as points of contact for relevant international organizations. Under CACNARE, the IAEA is expected to receive requests for and offers of assistance, and to coordinate them if requested by the affected state or states. The IAEA is also expected to make its own resources available to assist. Again, it is required to keep a database of competent authorities and points of contact (usually these will be the same for the two conventions).

According to the NEA, by the early 2000s the international emergency and response systems established by the two treaties were becoming outdated and needed revision (INSAG, 2006: 5). To this end, the IAEA began convening biennial meetings of the Competent Authorities. The second such meeting, held in June 2003, established a National Competent Authorities' Co-ordinating Group (NCACG). Consisting of a chair and six members representing regional groups, NCACG coordinates the inter-sessional tasks assigned to competent authorities by the biennial meetings.

One of the products of NCACG, in cooperation with the IAEA Secretariat, was the 2004 *International Action Plan for Strengthening the International Preparedness and Response System for Nuclear and Radiological Emergencies* (not to be confused with the 2011 post-Fukushima Action Plan). It identified "important" reforms in international assistance, emergency communications and infrastructure to be implemented by 2009 by member states, other stakeholders and the Agency. These included "improving the flow and security of data" exchanged by member states and international organizations. Progress reports on the plan were endorsed at Competent Authorities meetings in 2005, 2007 and 2009. With unfortunate timing, a final report on implementation of the plan was to be submitted to the BoG in March 2011, just as the Fukushima events occurred (IAEA, 2011d: 61). It is clear from the crisis itself and from the post-Fukushima Action Plan's call for the International Plan to be "reviewed and strengthened" (IAEA, 2011j: 3) that it was never completely or satisfactorily implemented.

One idea for reform, with the goal of bringing some consistency to state practice, was the preparation of a Code of Conduct on International Emergency Management. The GC welcomed the initiative in September 2006 (IAEA, 2006f). However, in December 2006, a technical meeting convened to discuss a draft provoked mixed views, with some states expressing concern as to whether a code was "the appropriate instrument to achieve the desired objectives" (IAEA, 2007b). References to work on a code have since disappeared, suggesting that the initiative is either languishing or has vanished, an example of the difficulties facing the attempt to strengthen global governance in some areas of nuclear safety. It is possible that states will have a different attitude in light of Fukushima.

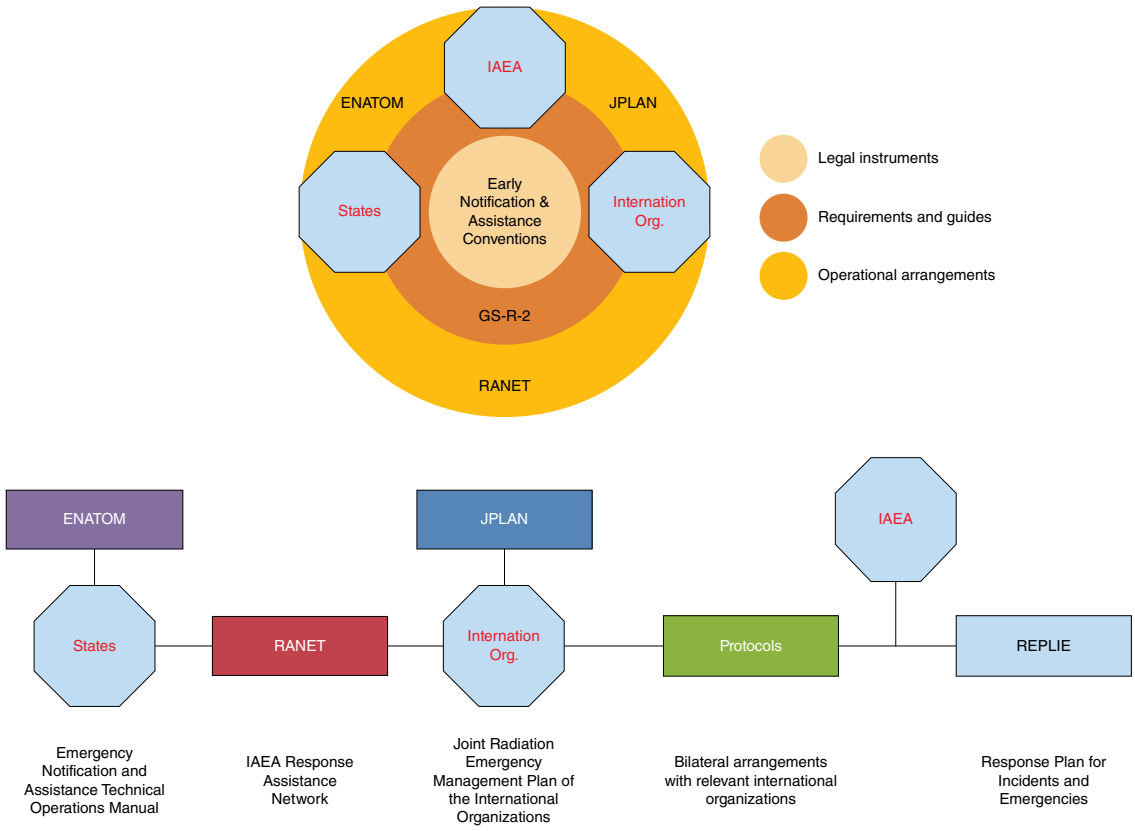
In 2010, the Agency conducted exercises with member states to test whether they had a contact point that could respond promptly to incoming messages at all times, whether their competent authorities could be activated on short notice and whether they were familiar with the notification procedures under CENNA and CACNARE (IAEA, 2011d: 62). The results were alarming. Fax messages could not be delivered to 23 percent of the contact points. Only half of them responded to the exercise messages and only 21 percent of them responded within 30 minutes. Only 78 percent of the competent authorities that were alerted responded promptly within the allowed time. These desultory results indicate how much improvement the system needed. There is no evidence that such improvements were made before Fukushima.

The post-Fukushima Action Plan, strangely, does not mention either of the nuclear accident conventions, but requests the IAEA Secretariat, member states and international organizations to review and strengthen the international emergency and preparedness response "framework," taking into account the recommendations of the final report on implementation of the International Action Plan. The Competent Authorities for CENNA and CACNARE held their first post-Fukushima meeting in Vienna from April 17 to 20, 2012, but recommended incremental changes and expanded cooperation and participation, rather than any major overhaul of their emergency response and assistance arrangements (IAEA, 2011q: 5).

IAEA Emergency Preparedness and Response Framework

The IAEA's various plans, arrangements and mechanisms for dealing with a nuclear accident or emergency, including those flowing from the two nuclear accident conventions, are subsumed under the Agency's "framework" for emergency preparedness and response. As the Agency notes, this framework is implemented independent of whether or not the two accident conventions are triggered (IAEA, 2011l: 1, fn 2). Its sprawling "elements" are illustrated, not very informatively, by the Agency's chart reproduced below.

Figure 3: Elements of the IAEA Emergency Preparedness and Response Framework for Nuclear and Radiological Incidents and Emergencies



Source: IAEA (2011l: 17).

Emergency Preparedness and Response Plans

Three plans are meant to guide the Agency, its member states and other relevant international organizations in case of a nuclear emergency. The IAEA Response Plan for Incidents and Emergencies (REPLIE) details how the IAEA Secretariat will organize itself in-house, "at the highest levels." The Emergency Preparedness and Response - Emergency Notification and Assistance Technical Operations Manual (EPR-ENATOM), meanwhile, sets out how the operational aspects of the two nuclear accident conventions, such as the provisions for notification and information exchange, are to be implemented and clarifies the roles of the IAEA, member states and international organizations. The Joint Radiation Emergency Management Plan of the International Organizations (JREMPIO), otherwise known as the Joint Plan or J-Plan, describes the roles and responsibilities of the international organizations and lays out the "interfaces" between them and with states.

According to EPR-ENATOM (IAEA, 2011l: 17), the IAEA's role in a "General Emergency" includes offering its "good offices," usually a term reserved for the UN Secretary-General in crisis management, but in this case presumably meaning offering to help in any way it can. Additionally, the Secretariat is supposed to monitor, analyze and assess emergency situations, including using its own technologies and other capacities; keep the general public, the media, member states and the international community informed; and provide post-accident assessment, remediation and recovery. The following are the major mechanisms available to the Agency for undertaking these functions.

Incident and Emergency System and Incident and Emergency Centre

Established in 2005, the IAEA's Incident and Emergency System consists of a 24-hour-a-day contact point known as the Emergency Response Manager and an operational focal point, the Incident and Emergency Centre (IEC). The system aims to share emergency information between states, their competent authorities, international organizations and technical experts, and facilitate

coordination of assistance. The IEC has several different levels of operation.[7] In an emergency, it is meant to be immediately brought into full operational mode with the necessary complement of staff manning the centre 24 hours a day. At the time of Fukushima, the Early Notification and Assistance Conventions (ENAC) website and the Nuclear Events Web-based System were available for distributing information to member states. In September 2011, unfortunately too late for Fukushima, the IEC launched its new Unified System for Information Exchange in Incidents and Emergencies (USIE), which had been under development since 2009, to replace the two old systems.

Response Assistance Network

The Response Assistance Network (RANET) is meant to be a global repository of information on national assistance available in case of a nuclear accident (IAEA, 2009d: 10). It was inaugurated in 2006, after its predecessor scheme attracted only one participant, Slovenia. Instead of setting out requirements for assistance, the new arrangement only makes recommendations. Unfortunately, by November 2010, only 19 member states had joined and registered offerings (Turai, 2010).

Inter-Agency Committee on Response to Radiological and Nuclear Emergencies

The Inter-Agency Committee on Response to Radiological and Nuclear Emergencies (IACRNE),[8] also formed after Chernobyl (UN, 2011c), is designed to coordinate the responses of the 15 international organizations that are its members.[9] The JREMPIO sets out how this should occur. The IAEA Secretariat serves as the committee's coordinator. In partnership with IACRNE, for instance, the Agency coordinates international emergency response exercises designed to identify weaknesses in international response capacities and mitigation strategies. The most recent was ConvEx-3 2008 held at the Laguna Verde reactor in Mexico, involving 75 countries and nine international organizations (IAEA, 2009d: 11).

International Nuclear and Radiological Event Scale

Nuclear and radiological events are publicly rated using the International Nuclear and Radiological Event Scale (INES), a scale designed in 1989 by the IAEA and the NEA (IAEA, 2001b). Originally only applicable to nuclear reactor accidents, it was extended and adapted in 2009 to cover events involving the transport, storage and use of radioactive material and radiation sources. The stated purpose of the INES is to communicate to the public and media the severity of events at nuclear facilities, using a seven-level scale ranging from "anomaly" to a "major accident." Chernobyl was ranked at Level 7, the only such event in history until Fukushima, while the Three Mile Island accident in 1979 in Pennsylvania, was rated Level 5.

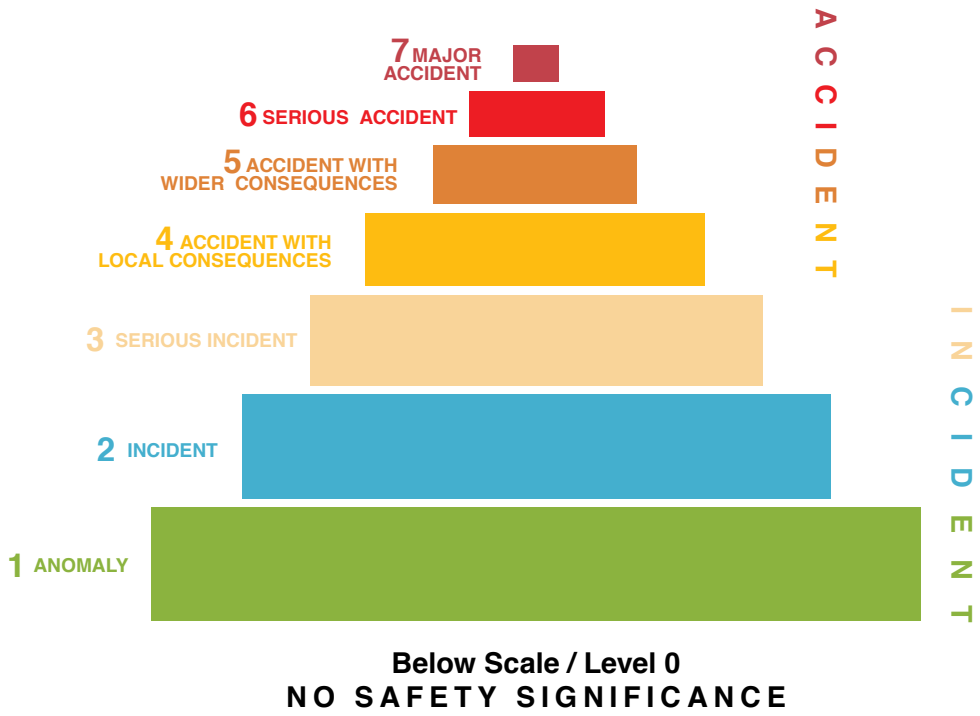
As in other areas of nuclear safety, the IAEA has standards dealing with emergency preparedness and response. The Agency assists member states in preparing emergency plans, developing training programs, transmitting requests for planning assistance, putting in place radiation monitoring programs and conducting feasibility studies of radiation monitoring systems. It also dispatches Emergency Preparedness Review Teams (EPREV) at a state's request, to evaluate emergency preparedness and make recommendations to improve it. Established in 2004, there had been 31 missions as of November 2011, with four to six typically conducted each year (IAEA, 2011q: 2). Over the past 20 years, the Agency has also dispatched expert teams on over 100 missions to investigate and review nuclear installations for their ability to withstand strong earthquakes (Kaiser, 2012). In addition, it has a little-known history of conducting fact-finding missions after earthquakes. Immediately after the Kawasaki earthquake in Japan in 2007, for example, the IAEA dispatched an expert fact-finding mission, with a follow-up mission in 2008. The post-Fukushima Action Plan recommends that member states conduct a prompt national review of their emergency preparedness and response arrangements and capabilities, followed by regular reviews thereafter, with IAEA support and assistance "as requested," using its EPREV missions (IAEA, 2011j: 3).

7 The IEC operates in three operational modes: Normal/Ready Mode, Basic Response Mode and Full Response Mode. In Normal/Ready Mode, the IEC is the focal point for incoming messages and operates systems that serve as a 24-hour-a-day warning point through which incoming messages are received and acted on. The following on-call officers are available to facilitate and coordinate a timely and adequate response: emergency response manager, nuclear installation specialist, radiation safety specialist, nuclear security specialist, external event specialist and logistic support officer. Each event is classified according to the extent of its actual or potential radiological consequences. The response actions vary according to the actual or potential magnitude and seriousness of the event. The on-call emergency response manager determines whether the IEC activates into Basic Response Mode or Full Response Mode (GOV/INF/2011/8, June 3, 2011) (IAEA, 2011l).

8 This replaced the previous Inter-Agency Committee on the Response to Nuclear Accidents.

9 Its 14 members, in addition to the IAEA, are: the European Commission, European Police Office, the FAO, the International Civil Aviation Organization (ICAO), the International Maritime Organization, the International Criminal Police Organization, the Organisation for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA), the Pan American Health Organization, the United Nations Environment Programme (UNEP), the United Nations Office for the Co-ordination of Humanitarian Affairs, the United Nations Office for Outer Space Affairs, the United Nations Scientific Committee on the Effects of Atomic Radiation, the WHO and the WMO.

Figure 4: International Nuclear and Radiological Event Scale



Source: www-ns.iaea.org/tech-areas/emergency/ines.asp.

RESPONSE TO THE FUKUSHIMA DISASTER

Initial IAEA Response and Offer of Assistance

On Friday, March 11, 2011, 56 minutes after the earthquake struck at 05:46 (Coordinated Universal Time), the Agency's International Seismic Safety Centre (ISSC) (see Safety of Nuclear Facilities and Material section) notified the IEC of the event and the potential for damage to nuclear power plants on the northeast coast of Japan (including Fukushima Daiichi) and the possibility of a tsunami.[10] Within two hours, the IEC was in touch with Japan's Nuclear and Industrial Safety Agency (NISA), the contact point designated by Japan under the nuclear accident conventions. An offer of Agency assistance was sent shortly afterwards to NISA and the Japanese permanent mission in Vienna. By 08:20, the IEC was activated, declared in Full Response Mode, and staffed continuously 24 hours a day thereafter.

By 08:06, the first information for member states and international organizations was posted on the ENAC website; by 08:25, the IEC distributed its first in-house email message; and by 08:30, the first press statement was released on the IAEA website. A Status Summary Report was faxed or emailed to all official contact points nominated under the two nuclear accident conventions and to all permanent missions in Vienna. The same day, the IAEA also asked the WHO to activate its emergency medical arrangements. This was an impressive beginning. The IAEA's role in notifying member states and fellow international organizations in accordance with the provisions of CENNA thus appeared to have worked well.

For the next few days, however, the Agency seemed ill-prepared to provide the leadership expected by member states, the media, the nuclear industry and the general public. An internal debate reportedly raged within the Agency as to whether Fukushima required simply a "technical" response or a more proactive, holistic, "political" response attuned to member states' expectations. According to Western diplomatic missions and other sources, DG Amano's initial inclination was to keep a low profile and wait until the Agency could produce a sober analysis of the situation from which to draw lessons for the future. This inclination was no doubt reinforced by the initial paucity of information coming from Japan. A group of Western member states, led by the United States,[11] pressed Amano to, at the very least, make a public statement as soon as possible. They also

10 The Secretariat has published a minute-by-minute account of its response as an annex to its report to the BoG of June 3, 2011. See IAEA, 2011l.

11 The group also included Australia, Canada, Germany and the United Kingdom.

urged him to go to Tokyo as soon as practicable, to at the very least be seen to be reacting to the crisis.

On Saturday, March 12, the day after the earthquake and tsunami, the Agency released a video statement by Amano, later posted on YouTube, essentially expressing the Agency's regret at what had happened and sympathy for the Japanese people (IAEA, 2011m). On Sunday, the DG held a briefing for member states on how the Agency might assist Japan. However, it was not until Monday, March 14 that the IAEA held a briefing on the accident for member states and the media, by which time the first hydrogen explosion had occurred at the Fukushima Daiichi facility, and the situation had become much worse. The DG, although supported by an array of IAEA experts and officials, appeared ill at ease and, not surprisingly, un-reassuring on the technical details. Amano did visit Tokyo from March 17 to 19, but was unable to visit the reactor sites due to safety concerns (he did eventually visit Fukushima for a full briefing and tour on July 25, 2011).

After realizing that the DG was not the appropriate person to be providing detailed briefings for member states and the media, the Agency swung in the opposite direction and elected to use technical experts. Like the DG, however, they too appeared uncomfortable in the media spotlight. The prepared statements they read out, undoubtedly drafted hastily as new information arrived from Japan, contained a great deal of data, but little useful information and context. Most damaging for the IAEA's image, they gave the impression that the Agency was simply relaying information provided by Japan, without any critical input by Agency experts. There were no graphics, flow charts or independent IAEA data displayed, even though the Agency had them or was preparing them. The Agency was even reluctant to release graphics showing how boiling water reactors of the type at Fukushima operated, even though the media were able to immediately reproduce perfectly adequate ones from open sources. The experts were able to answer questions in technical terms, but diplomats were bemused as to how to report this back to their governments. It took a week to get information on the afflicted Daiichi reactors from the Agency's safeguards confidential system, as Japan had to approve its release. The Agency appeared to assume that it had no business releasing independent information relevant to the emergency.

The lack of timely, accurate information from the Japanese authorities compounded the Agency's difficulties. Japan did notify the IAEA within two hours that an accident had occurred, in compliance with CENNA, and it claims that it "made every effort to provide information promptly and accurately to the IAEA, the most important international organization dealing with nuclear safety issues" (Government of Japan, 2011b: IX-7). In reality, Japan's provision of detailed, accurate information was inadequate to the point where, on a strict legal reading, it could be said Japan failed to comply with CENNA. Some of the initial information proved to be grossly inaccurate and left the Agency looking at best ill-informed and at worst deceived. Frustrated by this situation, DG Amano expressed to Japanese Prime Minister Naito Kan and other officials during his visit to Tokyo the need for faster and more accurate information. Remedies were put in place, including sending a senior IAEA official to the IAEA's Tokyo office, the designation of IAEA liaison officers at NISA and the dispatch of IAEA radiation monitoring teams to transmit real-time data to Vienna.

It is not clear from publicly available information how the REPLIE protocols, detailing the roles of the IAEA's own senior staff, fared during the Fukushima crisis. The attitude and actions of the DG would, however, have been critical in triggering the implementation of REPLIE in the echelons below him, especially those charged with implementing the Agency's public information strategy for such events. The Agency did establish a Fukushima Action Coordination Team on March 15 to ensure interdepartmental coordination, followed by two support teams for nuclear safety and radiological consequences (IAEA, 2011l: 6). Scores of Agency personnel worked long hours and with great dedication during the emergency to fulfill the Agency's mandate. By May 15, 2011, more than 150 professional staff and more than 50 general service staff had volunteered for shift work and served in the IEC. This included Japanese staff members (under-represented in the Agency) who acted as accident liaison officers and assisted with communications by translating information from and into Japanese (IAEA, 2011l: 4).

The Department of Public Information maintained continuous emergency communications with the press and general public from March 11 to April 22. A purpose-built emergency update website (Alert Log) was activated on March 11. To handle the thousands of telephone calls and emails, extended shifts were established and temporary support staff deployed. The massive volume of traffic to the IAEA's website following the accident brought down its Web servers (not an unusual event when there is a high volume of traffic, and one that even information technology companies have trouble avoiding). Service was eventually restored, but in the meantime, the Agency expanded its use of social media such as Twitter and Facebook to bring updates to the public. From March 15, the department arranged 16 press conferences and drafted over 120 updates for the Agency's website (IAEA, 2011l: 12). The Agency did eventually begin to produce its own charts based on its own expertise and monitoring efforts, as well as satellite imagery purchased commercially (IAEA, 2011l: para. 54).

Emergency Assistance Coordination

With respect to the implementation of CACNARE, over a dozen countries promptly notified the Agency that they could offer assistance, which the Agency immediately conveyed to the Japanese government. The Agency's coordinating role, however, was stymied by Japan's failure to initiate the convention and its preference for dealing bilaterally with a small number of other governments. RANET was, as a result, rendered irrelevant. As the interim report of the Japanese government into the Fukushima disaster (published in December 2011) shows, the Japanese response was so chaotic

in the first days that the government was in no position to advise international donors on what assistance it required or could manage to absorb (Government of Japan, 2011a). Nonetheless, a Japanese official reported that a deliberate decision was made not to trigger the convention, even when it became obvious that international assistance of various types would be needed and could be identified.[12] The reasons for this decision are not clear, but are reportedly subject to an internal investigation in Japan. In any case, Japan could have triggered the convention as an indication of goodwill towards the international community and the Agency, which were so willing to help.

Some of the press criticized the Agency itself for not rushing to assist Japan as soon as the crisis occurred. As DG Amano correctly pointed out, however, the IAEA is not a nuclear safety "watchdog" (although that is its role for nuclear safeguards, and some states, such as Germany, think it should assume such a role in safety). Currently, the Agency has no power to either force member states to prepare for nuclear emergencies or to impose itself on them when emergencies do occur.

Coordination of International Organizations

With respect to the coordination of international organizations, IACRNE's Joint Plan (J-Plan) was reportedly triggered the day of the disaster (UN, 2011c: 23). Intensive consultations by telephone and email took place. IACRNE's first coordination meeting (by video conference) was convened on March 15 as the situation began to deteriorate (UN, 2011c: 22). The same day the WMO, FAO and an expert from the Austrian National Weather Service were invited to join the IEC. A further 10 IACRNE meetings on Fukushima were held between March and June 2011, allowing the partners attending to coordinate their activities. One question that exercised the meetings was the speed in which the WMO's regional specialized meteorological centres for environmental emergency response could be up and running.

One significant glitch was that the Secretariat of the Comprehensive Nuclear-Test Ban Treaty Organization Preparatory Commission (CTBTO Prepcom) was not invited to participate in the meetings until April 11 (UN, 2011c: 23) as it was not a member of the group. The CTBTO had been using its International Monitoring System, designed for detecting and identifying nuclear tests, to track radionuclide dispersal from the stricken plants, including eastward into the Pacific Ocean, from the outset of the crisis (CTBTO Prepcom, 2011). It was an obvious partner in international collaboration to deal with the disaster.

On March 25, the UN Secretary-General Ban Ki-moon convened a video conference of key international organizations to consider their collective response to Fukushima, and afterwards issued a press release that was, at the very least, ambiguous in its assessment of their performance. While asserting that "The international organizations responsible for coordinating action with Governments and other organizations have pursued extraordinary information-sharing measures," he also declared that "The existing institutional arrangement, including the Joint Radiation Emergency Management Plan of the International Organisations, with the IAEA as the main coordinating body, needs to be reviewed and strengthened" (UN, 2011b). It is not clear why the IAEA, as the central coordinating body, had not called the video conference. The post-Fukushima Action Plan makes no reference to IACRNE, but does encourage greater involvement by the relevant international organizations in JREMPIO (IAEA, 2011j).

INES, meanwhile, did not fare well as a communications tool, especially after the Japanese government suddenly upgraded the events one month after the disaster from Level 3, 4 or 5 (depending on the reactor unit affected) to Level 7 for the accident as a whole (Government of Japan, 2011b: IX-9 and IX-10). Although Fukushima was severe, the amount of radioactivity released was estimated to be considerably less than that released at Chernobyl.[13] On the other hand, it involved several nuclear reactors, not just one, as was the case at Chernobyl. Many observers were surprised that it was not the IAEA that employed the INES to declare the accident level, but the country that endured the accident. Since states have strong incentives to downplay the severity of an accident on their territory, especially if it is of their own making, it seems ill-advised for the country to be responsible for employing the INES. In the case of Fukushima, the Japanese government seemed to err in the other direction, making a comparison with the existing "worst case" (Chernobyl) that seemed, in some respects, uncalled for. DG Amano conceded that the "INES proved to be an ineffective tool" (Amano, 2011b). Work on revising the INES began at a meeting of the INES Advisory Committee in October 2011 (IAEA, 2011q: 7). The need to discuss the rating of aquatic releases of radioactivity, like those that occurred at Fukushima, was one of the issues identified. The development of additional guidance on the application of INES began in February 2012.

In terms of post-disaster monitoring and studies, the Agency has done well. It has dispatched expert missions in short order to: monitor radiation levels, assist with and conduct investigations into what transpired and help with remediation analysis and efforts (IAEA, 2011k). Having been loath to involve the Agency in the days immediately following the accident, Japan has veered in the other direction and sought IAEA validation in almost every aspect of its efforts. Clearly bruised by international criticism from its neighbours, notably China and South Korea, and presumably by DG Amano's admonishments in Tokyo, Japan has subsequently evinced a degree of transparency and openness that is astonishing for a country that

12 From an off-the-record seminar at Harvard University with a senior Japanese safety official.

13 The amount of iodine-131 escaping from all the reactors at Fukushima Daiichi was less than 10 percent of the amount released at Chernobyl, and the release of caesium-137, the next most important fission product, was less than 15 percent of the Chernobyl total. See Higson (2012).

is normally considered somewhat opaque in its dealings with the rest of the world.

After the accident, the Agency sent four radiological monitoring teams to help validate the results of Japanese monitoring efforts. The Agency's Environment Laboratories in Monaco reviewed information regarding the marine environment and liaised with other organizations, including the CTBTO, to create models to simulate the dispersion of radioactive material into the ocean. The Agency's Environment Laboratories at Seibersdorf in Austria analyzed samples collected during IAEA missions to Japan, while the IAEA Radiation Monitoring and Protection Services Laboratory provided radiation protection and advice to all IAEA, WHO and FAO staff travelling to Japan (UN, 2011c: 28). The IAEA and FAO dispatched a joint Food Assessment Team to assess radioactivity levels in food supplies.

The Agency's International Fact Finding Expert Mission (IAEA, 2011s) has produced a major report on the disaster and a separate mission has reported on remediation of the large contaminated area beyond the Fukushima facility (IAEA, 2011k). With the critical involvement of the ISCC, the Agency quickly produced a methodology to assess the resilience of nuclear power plants against extreme natural hazards. This has been used to review Japan's conduct of so-called stress tests on its remaining fleet of reactors, almost all of which have been shut down, to inform decisions on whether to permit them to resume operations (IAEA, 2011n).

CONCLUSIONS

The overall global governance of emergency preparedness and response has advanced since the Chernobyl disaster from non-existent to a complex web of treaties, arrangements and measures. On the surface, the IAEA's role has also grown and the Agency is increasingly seen as a central actor. Yet, the system is fragmented and often incoherent, with too many plans, programs (not to mention acronyms) and players for even the most attentive of member states to understand or participate in. Even the post-Fukushima Action Plan treats the issue disjointedly, and does not even mention all of the players or treaties involved, as if no one person has a grasp of the entire system. For a start, the Secretariat needs to review its confusing Venn diagram that purports to set out the emergency response framework.

The Secretariat, for its part, seems frustrated by member states' general inattentiveness to the issue and the inability of governments to follow through on even modest improvements to international and national systems, not to mention the lack of resources for strengthened programs. The Agency appears to face an uphill battle in convincing its member states to take nuclear emergencies seriously. The IAEA's 2008 Nuclear Safety Review confirmed that member states with nuclear installations tend to have adequate capabilities to deal with local incidents and emergencies, but only a few could respond well to a major nuclear emergency (IAEA, 2009d: 7). Fukushima demonstrated that even a sophisticated country like Japan, with multiple nuclear facilities, did not have the necessary preparations in place for a disaster of that magnitude, despite its decades-long experience with nuclear power and centuries of experience with earthquakes and tsunamis. States without significant nuclear facilities, even those whose neighbours might have them, tend to have no response systems in place. If and when increasing numbers of states acquire nuclear power plants, the IAEA will need to draw them tightly into a strengthened emergency response system, beginning with ratification of the two major conventions, CENNA and CACNARE, and full compliance with their obligations.

Quite apart from the inadequacies of its member states, the IAEA's own nuclear emergency preparedness and response system faced, with Fukushima, its greatest test so far and, at least partly, it failed. The Agency itself presciently warned the 20/20 Commission in 2008: "As the use of nuclear technology expands so will the expectations of States for the IAEA to coordinate the international response to emergencies in accordance with roles assigned to it by international conventions. The IAEA has established an incident and emergency centre but its ability to carry out these roles is insufficient" (IAEA, 2008a: 19).

The Agency as Information Hub

Criticism of the Agency's performance as the expected provider of information and analysis to member states, the media and general public during the Fukushima crisis — "the global focal point for nuclear cooperation" (UN, 2011c: 15) — has been widespread, some of it justified, some not. Deadly dull technical briefings and uninspired media performances did nothing to enhance the Agency's reputation. What the Agency really needed was a telegenic spokesperson to sell the Agency's message confidently, in the style of White House spokespersons. In this information-saturated age, the IAEA needs a more professional, media-savvy approach if it is to continue to credibly claim to be the "hub" of anything. Information provided by the Agency needs to be readily accessible by a general public whose level of understanding of nuclear matters is low and often ill-informed.

The decision to release information only from Japan or that had been cleared and checked with the Japanese authorities gave the impression of the Agency kowtowing to one member state, which should always be avoided. While it is laudable, as the DG repeatedly stressed, that the Agency would only release "authenticated and verified information," this should not have been taken to imply that the Agency is only mandated to disseminate information provided by the state that has suffered an accident. In fact, as the fine print of the Agency's own report on its reaction to Fukushima makes clear, "authenticated and verifiable" are technical terms meant specifically to apply to notifications received under CENNA: "In this context, authentication is the process of confirming that the message received originates from an official contact point. Verification is the process of confirming that a message received is clear, consistent and understood" (IAEA, 2011l: 22). CENNA is in fact silent on whether the

Agency may disseminate information other than that provided by the injured party (IAEA, 1986: Art. 4).

One can sympathize with the difficulty the Agency faced in obtaining timely, accurate information from Japan in the first days after the disaster. As the final report on Fukushima from the United Kingdom notes, conditions at an accident site may make it difficult, if not impossible, to obtain all necessary data at the early stages. The operator's priority is to "provide such information as is available to its national authorities, while at the same time trying to restore control on the site" (Government of the United Kingdom, 2011: 151). Moreover, even the most capable and well endowed of national nuclear authorities had difficulties finding their way through the "fog of information" during the earliest days of the Fukushima crisis, and were perplexed as to how to react. Email traffic has revealed that the US Nuclear Regulatory Commission (NRC) found itself in this situation, with one official bemoaning three days after the disaster that "It's frustrating, but we have very little info as an agency" (Mufson, 2012).

But the IAEA was also slow in providing information that was already available to it, which it could readily have obtained or could have prepared in advance for use in any nuclear accident. As former IAEA DDG Olli Heinonen notes, the Agency "should give its own independent assessment using all the information that is available. If information isn't available the agency should seek it actively" (Brumfiel, 2011). This would include, for example, information on how a particular reactor operates, the hazards posed by natural events to nuclear reactors and the various safety measures that are in place. The United Kingdom has suggested that two types information are needed during a nuclear emergency. The first is basic data about reactor design, including reactor type, containment, thermal power, protection systems, operating history and the condition of nuclear materials such as spent fuel that is stored on-site. Since this information would not change significantly over short to medium timescales, it could be held permanently in a central database on behalf of the international community, presumably by the IAEA, "noting the need to ensure data provenance and access control" (Government of the United Kingdom, 2011: 151). The second type of data required concerns an accident's progression and the prognosis for future developments, again to be routed through a central system, presumably, once again, the IAEA. The most novel UK suggestion, however, is that international agreement should be sought in advance on "the type of information that needs to be provided and its routing" (Government of the United Kingdom, 2011: 151).

There has been a clamour since Fukushima for the Agency to do better. In implied criticism, the post-Fukushima Action Plan pointedly calls for the Secretariat to in future prepare itself to provide member states, international organizations and the general public with "timely, clear, factually correct, objective and easily understandable information during a nuclear emergency on its potential consequences, including analysis of available information and prognosis of possible scenarios based on evidence, scientific knowledge and the capabilities of Member States" (IAEA, 2011j: 6). The UN Secretary-General's report on intra-UN coordination during Fukushima called for "expanding" the IAEA's role in receiving and disseminating information, and better addressing the huge public demand for information through one-voice messages (UN, 2011c: 23). Even before Fukushima, the UN's Counter-Terrorism Implementation Task Force (CTITF), emphasizing that a nuclear terrorist incident could cause a similar emergency, advocated a "high level of effective and efficient coordination of public information between the UN and all relevant international organizations in order to facilitate accurate and consistent reporting by the media, thereby helping to assuage public fears and prevent panic" (CTITF, 2010: 23).

The Agency now recognizes this need. As it coyly admitted in its Annual Report for 2010 (released in 2011): "The main lesson learned is that the general public considers that the work of the Agency is highly sensitive and that its impact is significant for the safety and security of the international community. It is thus important to provide accurate and timely information on major developments in the nuclear field. This is why the Agency has to continue to improve its outreach capacity" (IAEA, 2011d: 162). Without explaining why he thought the Agency's existing role in the case of an accident was "largely limited to distributing information validated by the country concerned to all other Member States" (Amano, 2011b), when in fact the Agency's own emergency plan lists several other roles, DG Amano told the June 2011 Ministerial Conference that: "our information-sharing function should be expanded to include providing analysis and possible scenarios on how a crisis might develop and the associated radiological impact." The IAEA could, he modestly suggested, either develop its own capacity or collaborate with others. Member states would need to provide funding for such efforts. It is taking a first step by organizing an international experts meeting on "enhancing transparency and communications effectiveness in the event of a nuclear or radiological emergency" in June 2012.[14]

The post-Fukushima Action Plan also calls on the Agency to "review the application" of INES as "a communication tool" (IAEA, 2011j: 6). The Secretariat has begun work on this. The IAEA and NEA should clarify that it should be the IAEA that determines the rating of a nuclear emergency using INES. This should be done in close consultation with the state (or states) concerned, but it should not be the state or states alone that make the determination. The international public and media are otherwise likely to be confused and skeptical about its use in the future.

Coordination with Other International Organizations

Surprisingly, in view of its importance, IACRNE is not mentioned by the post-Fukushima Action Plan. The IAEA Ministerial Conference on Nuclear Safety, while describing it "an effective and useful mechanism," called for it to "now be carefully reviewed and enhanced" (IAEA, 2011o: 5). Relevant organizations were encouraged to become

14 Informal communication with the IAEA.

members. IACRNE met in December 2011 to discuss the effectiveness of JREMPIO and other areas of interagency cooperation (IAEA 2011q: 3).

As previously mentioned, the biggest glitch in the interaction between the IAEA and other international organizations concerned the CTBTO. The DG urgently met with Executive Secretary Tibor Tóth on March 16 (followed by a formal letter on March 17) to request Agency access to data from the CTBTO's radionuclide network in order to track the radioactive plume from the disaster. Tóth agreed immediately and informed CTBT state signatories accordingly. Release of the data to the IAEA began on March 18 (CTBTO, 2011). Surprisingly, there was no protocol already in place to have this information relayed to the IAEA automatically, despite the proximity of the two organizations in the same building in Vienna and what one would expect to be a close relationship. The need for the IAEA to have such data in the event of an accident should have been entirely predictable. The lack of automatic data exchange between the two organizations is due to opposition in the BoG to a 1998 report by a Joint IAEA/CTBTO Consultative Group on a comprehensive IAEA/CTBTO cooperation agreement. Such cooperation was opposed within the BoG by an unholy alliance of states, including China, India and the United States, on several grounds: that the CTBT had not yet entered into force; that it has different states parties to that of the IAEA Statute; and that CTBTO data should only be provided to CTBT signatories. Having seen the utility of the hastily arranged IAEA/CTBTO cooperation in the Fukushima case, it is hoped that such states will accept the de facto situation.

On March 21, 2011, the two organizations deepened their cooperation by establishing a joint CTBTO-IAEA team of experts comprising two to three representatives of each organization to make effective and efficient use of the data and data products provided by the CTBTO (CTBTO Prepcom, 2011).

The IAEA has, in the interim, called for it to be allowed to establish a global radiation monitoring platform to display real-time data on radioactive releases and integrate data from international and national monitoring and early warning systems (UN, 2011c: 29). Rather than obliging the CTBTO to simply hand over its data, as the Agency has proposed, it may be better to establish a joint IAEA/CTBTO initiative.

Emergency Information Exchange

Some improvements have already occurred in the area of emergency information exchange. As mentioned, the new USIE was launched in September 2011. The new system hosts two interfaces. The first is a protected website accessible only by designated users in IAEA member states. All reporting, data entry and requests for assistance will take place through this interface. The second is a public read-only website. USIE users can choose to be alerted by text, email or fax whenever new information is issued about any type of incident, ranging from a lost radioactive source to a full-scale nuclear emergency. The system tracks multiple events and only issues information authenticated by the country reporting the incident. IEC head, Elena Buglova, claims the new system will strengthen international coordination, making the global response to all types of nuclear and radiological emergencies quicker and more effective: "For the first time, this simple-to-use and effective system streamlines mechanisms for reporting and sharing information about incidents and emergencies in a secure information exchange channel" (WNA, 2011).

The post-Fukushima Action Plan suggested that consideration be given to "enhancing and fully utilizing [RANET], including expanding its rapid response capabilities" (IAEA, 2011j: 3). It also proposed that member states consider voluntarily establishing rapid response teams that could be made available through RANET. France proposed that the Agency establish its own teams, but maintaining such standby arrangements for a once-in-a-decade event did not strike other delegations as cost-effective. Incredibly, the Japanese government criticized RANET after Fukushima, noting that the network "would be able to respond to any accident more quickly and effectively if more specific information were registered such as the specifications of supplies and equipment which can be provided and their quantity" (Government of Japan, 2011b). Japan has since registered three organizations that specialize in radiotherapy and other fields, and said it hoped to contribute to the development of RANET by "further promoting and expanding the scope of it." Yet, even if RANET had been fully subscribed, Japan's refusal to use it would still have rendered it useless. A meeting to discuss the extension of assistance capabilities under RANET and the effectiveness of ENATOM was planned for "early 2012" (IAEA, 2011q: 3). A redraft of ENATOM is being prepared by the Secretariat to reflect the new USIE web-based communications tool (IAEA, 2011q: 7).

The Agency has also reportedly initiated a review of its own capabilities and arrangements for assisting in the event of a nuclear or radiological emergency (IAEA, 2011q: 3). This includes development of advance operational arrangements for deploying fact-finding missions to replace the previously ad hoc arrangements. A planned workshop on this initiative and reporting processes for the Agency's mind-bogglingly titled Response Assistance Network Field Assistance Teams was brought forward to October 2011.

The Agency's responses to date will, perhaps understandably, result in tinkering with the existing system. Fukushima arguably indicates the need for an overhaul of the international nuclear emergency preparedness and response framework. This could start with the Agency itself. Its various confusing mechanisms and initiatives in this area need to be rationalized and integrated into one seamless system. The Action Plan is, unfortunately, not much use in this endeavour, as it is also a patchwork of initiatives. In addition, member state support would need to be garnered for a more comprehensive effort. Pending such an overhaul, which would take some time, the IAEA needs to continue to urge and assist member states to implement the many sensible individual recommendations of the old International Action Plan and the post-Fukushima Action Plan.

RECOMMENDATIONS: EMERGENCY PREPAREDNESS AND RESPONSE

- The Agency should overhaul its emergency communications and preparedness framework and plans to make them more coherent and seamless.
- Member states should provide more funding and resources for enhancing the IEC.
- IACRNE should review its procedures for collaboration during nuclear emergencies to ensure they are as streamlined and effective as possible, and admit the CTBTO to full membership.
- Member states should ensure their competent authorities and points of contact are notified to the IAEA and kept up-to-date
- Member states should expand their contributions to RANET.
- The Agency should collect information in advance from states about their nuclear facilities for use in case of an emergency and make advance preparations for collecting accident data from the state or states involved, as well as from relevant international organizations.
- The IAEA and CTBTO Prepcom should jointly establish a global radiation monitoring mechanism, including a platform to display real-time data on radioactive releases and integrate data from international and national monitoring and early warning systems (UN, 2011c: 29).
- The Agency should overhaul its communication strategy for nuclear emergencies to permit it to provide information in a more timely, user-friendly and media-savvy fashion; it should make clear that in future it will use it own sources of information, expertise and experience to provide the best possible service to its member states and the general public during an emergency; member states will need to provide the Agency with additional resources to achieve this.
- The IAEA and NEA should pursue their re-evaluation of the design and use of INES; the Agency alone, in consultation with the state(s) affected by a nuclear accident, should be authorized to use the scale in the case of a major emergency.

SAFETY OF NUCLEAR FACILITIES AND MATERIALS

The Agency's involvement in the safety of nuclear facilities and materials derives from international treaty obligations, as well as from a gradual accretion of responsibilities and functions, as is the case with its role in accident preparedness and response. A large part of its role is establishing and promoting safety standards for states to follow with respect to nuclear reactors and materials, including nuclear waste and spent fuel, and providing assistance to states to improve their national nuclear safety regimes. To the outsider, there is again a bewildering array of programs and mechanisms. Since Fukushima, there has been great debate within the Agency about "thickening" its role in nuclear safety.

The IAEA's Role in Implementing International Treaties

The two main international agreements in this area are the 1994 Convention on Nuclear Safety (CNS) and the 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Convention on Nuclear Safety

Before the adoption of the CNS in 1994 and its entry into force in 1996, there was no legally binding nuclear safety regime. As of June 2011, there were 65 signatories and 74 contracting parties to the CNS, including EURATOM (IAEA, 2011aa). All states that currently have operating nuclear power plants or are in the process of building them — with the significant exception of Iran (IAEA, 2011d: 119, table A9) — are parties to the CNS.

The treaty applies to land-based civilian nuclear power reactors, including existing, decommissioned and future plants. It also covers radioactive waste and spent fuel from these nuclear installations, if treated and stored at the same site (IAEA, 1994). Unfortunately, the CNS excludes facilities that are part of the nuclear fuel cycle — those for fuel fabrication, uranium conversion and enrichment, and reprocessing — although parties may apply to have them covered. This represents a significant lacuna in the nuclear safety regime.

While legally binding, the treaty only sets out an international safety "framework" that states parties should operate within. Parties commit themselves to implementing broad "fundamental safety principles" rather than detailed safety standards. These cover, for instance, plant siting, design, construction, operation, the availability of adequate financial and human resources, the assessment and verification of safety, quality assurance and emergency preparedness.

The CNS has no monitoring, verification or compliance system, and no penalties for non-compliance. The convention's preamble vaguely describes itself as an "incentive instrument," although it is not clear how this differs from other treaties, which usually contain incentives of some type. Instead of verification, state parties commit themselves to peer review — at the time, a significant innovation in nuclear governance. This entails each party providing all others with a detailed periodic national report on the measures taken to implement the convention. Review meetings are convened every three years to review the reports, with states usually represented by their national regulators. The texts are submitted six months in advance and circulated to all contracting parties to allow for written exchanges of questions, answers and comments. Unusual in an international agreement, attendance at the review meetings is mandatory.[15]

A comprehensive assessment of the implementation of the CNS may be found in CIGI's 2010 report, *The Future of Nuclear Energy to 2030 and Its Implications for Safety, Security and Non-Proliferation* (Findlay, 2010c: 24-26), but in brief, there has been continuing improvement in parties submitting national reports, attending and participating in the review meetings, and enhancing the substance and transparency of their reports. The peer review process is clearly effective in exposing the parties to critical scrutiny. The national reports are carefully examined, at least by the more capable states, detailed questions are asked in advance and during the session, and at times there is reportedly polite but pointed probing. Representatives are pressured to not just provide assurances that problems will be fixed, but are expected at the subsequent meeting to provide information on the steps actually taken. Prior to the Fukushima disaster, Japan had been repeatedly pressed in CNS review meetings to ensure greater independence for its regulator, although regrettably it failed to heed such advice.

The first triennial review meeting to be held after Fukushima, in April 2011, paid great attention to what had occurred, but found it was too early to draw definitive conclusions for strengthening, if necessary, the treaty regime (IAEA, 2011cc). This did not deter Russia from submitting several vague proposals for amendments to the treaty, the most notable of which was to apparently make it legally binding for states to implement nuclear safety standards "no less than that provided for by the IAEA standards."[16] The parties decided that a special review meeting would be held in mid-2012 to consider the implications of Fukushima, at which point amendments could be considered. A report by each state party on its responses to the accident is to be submitted three months in advance, covering the results of "stress tests" or other investigations into nuclear power plant design and operation, as well as steps planned and already taken to improve nuclear safety (Government of the United Kingdom, 2011: 151; IAEA, 2011cc).

The CNS keeps the IAEA curiously at arm's length, a reflection of differences among the negotiating states about the role the Agency should be given in nuclear safety. The negotiating history reveals that the principles encapsulated in the treaty derive "to a large extent" (but with some weakening) from a 1993 IAEA document *Safety Fundamentals: The Safety of Nuclear Installations* (IAEA, 1993).[17] However, no specific reference is made to the IAEA principles in the treaty. Nor is there a reference to the IAEA's more specific, detailed safety standards, although all the negotiating states agreed that these would be used as valuable input when the parties met to review compliance. The negotiators also rejected proposals to give the IAEA a role in monitoring or verification, as it has in respect of nuclear safeguards.

The Agency's formal duties in implementing the CNS are restricted to two: the DG is designated as the treaty's depositary and its Secretariat acts as the secretariat for the meetings of states parties. In practice, however, the Agency has a significant degree of influence on the treaty's operation, which has increased over time simply by virtue of organizing the review meetings and peer review system, promoting nuclear safety, assisting states in achieving it and by promulgating influential (if non-binding) safety standards and guides. During the peer review process, for instance, states often turn to the Agency for advice on technical, legal and other issues.[18] In addition, the Agency issues guidance, "established by the Contracting Parties" and "intended to be read in conjunction with the text of the Convention," on how to interpret compliance and how to report on it (IAEA, 1999c and 1999d). Finally, simply by being able to observe the peer reviews that all parties are subjected to, the Agency gains an excellent overview of compliance with the treaty (arguably better than most states parties). It can use this information to informally prod states to improve, notably by offering them review services and assistance.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The Joint Convention is the first multilateral legal instrument to directly deal with spent fuel and radioactive waste, a major challenge given that these substances will, in some cases, need to be managed safely well beyond the present generation on "evolutionary" timescales. The Convention was adopted and opened for signature in 1997, and entered into force in 2001. Its objectives are to:

15 Instead of being attached to the convention itself, a non-binding Annex was attached to the Final Act of the diplomatic conference that clarifies procedural and financial arrangements, the expected form and content of national reports, and the conduct of review meetings.

16 Statement by the Director-General, State Atomic Energy Corporation "Rosatom," S.V. Kirienko, IAEA Ministerial Conference on Nuclear Safety held in Vienna on June 20, 2011.

17 Another document the treaty drew on was the "Draft Safety Fundamentals: The Principles of Radioactive Waste Management" being prepared at the time under the Radioactive Waste Safety Standards program. While Articles 7–19 of the convention are literal versions of the safety fundamentals language modified only to fit treaty format, others were weakened (for example, while the Fundamentals require the establishment of policies that give safety the highest priority, Article 10 requires only "due priority."

18 For instance, the Agency prepares legal advice about changes to the way the CNS is implemented and whether or not a treaty amendment is required. See MacLachlan (2008: 17).

- achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste[19] management by enhancing national measures and international cooperation, including technical cooperation;
- ensure that during all stages of spent fuel and radioactive waste management there are effective defences against potential hazards so that individuals, society and the environment are protected from the harmful effects of ionizing radiation, now and in the future (a notably more expansive safety remit than the IAEA is formally granted in the IAEA Statute); and
- prevent accidents with radiological consequences and to mitigate their consequences should they occur (IAEA, 1997a: Art. 1).

As of September 2011, there were only 63 states parties plus EURATOM, and 42 signatories, far fewer than for the CNS. All states with civilian nuclear reactors have ratified the Joint Convention — with the significant exceptions of India, Mexico and Pakistan, which have not even signed. Many countries with nuclear energy ambitions have not signed either, including Bangladesh, Egypt, Jordan, Turkey, Venezuela and Vietnam. The treaty is, therefore, less widely supported than the CNS, which naturally affects the Agency's role in regard to those that are absent.

The treaty closely follows the CNS model of periodic review meetings, national reports and peer review, and in terms of IAEA involvement. As in the case of the CNS, the Joint Convention requires parties to attend periodic review meetings to consider mandatory national reports submitted by each party detailing the measures it has taken to implement its obligations. These reports should specify each state party's spent fuel and waste management policy, practices and classification system. Each report must also provide a list of the spent fuel management facilities and radioactive waste facilities, their location and essential features, and an inventory of spent fuel and radioactive waste.

Not only does the IAEA act as the secretariat for these meetings, but as in the CNS case, it has produced guidelines for states, based on the outcome of the first review conferences as to how states parties should compile and submit national reports and how the review process should operate (IAEA, 2006e). As is the case with the CNS, the Agency's influence on the treaty and its operation has grown over time. Its safety standards for nuclear waste and spent fuel are, again, non-binding but influential.

The next Review Meeting for the Joint Convention, to be held in May 2012, will consider the effectiveness of the convention in the light of the events at Fukushima, where spent fuel was a contributing factor in radiation release.

19 Spent fuel is nuclear fuel that has been irradiated in a reactor core. It may be reprocessed to produce uranium and plutonium, which may be recycled as reactor fuel. Radioactive waste is defined as radioactive material in gaseous, liquid or solid form for which there is no foreseen further use and has been declared as radioactive waste.

IAEA Safety Standards

Predating and apart from its role in helping implement the multilateral nuclear safety treaties, the IAEA has created comprehensive, detailed sets of safety standards covering all aspects of the peaceful uses of nuclear energy: radiation safety, radioactive materials transport safety, radioactive waste safety and nuclear safety. These safety standards encompass the life cycle of the nuclear enterprise, from establishment of an adequate legislative and regulatory infrastructure, through radiation protection, reactor site evaluation and design, to the safe operation and, ultimately, safe decommissioning of nuclear power plants.

Over time, the IAEA's safety standards and guidelines have, partly due to the absence of any other internationally recognized alternatives, acquired global credibility and legitimacy. They are now considered by all states to be the international benchmark, including in measuring states' compliance with the international safety conventions. The more advanced nuclear states undoubtedly consider the IAEA standards a floor rather than a ceiling, and often agitate to strengthen and extend them, but even they measure their performance, in at least some respects, by reference to IAEA documents. IAEA safety standards are seen as especially important in providing a baseline for states seeking to acquire nuclear power for the first time.

Part of the reason for the general acceptance of IAEA standards as legitimate and influential is the way in which they are produced. The IAEA's Commission on Safety Standards (CSS), a standing body of senior government officials from member states with national responsibility for nuclear safety, is mandated to advise the Agency on nuclear safety standards.[20] The development of standards is overseen by the Commission and its various safety standards advisory committees (on nuclear safety, radiation safety, transport safety and waste safety), which have wide representation of member states. The Commission provides guidance on the approach and strategy to nuclear safety standards; resolves outstanding issues referred to it by its committees; endorses the texts of safety documents before submission to the BoG or DG; and provides advice on promoting their worldwide application. To further ensure the broadest possible support from member states, draft Safety Fundamentals and Safety Requirements are submitted for approval to the BoG, while Safety Guides, which are issued by the DG, are submitted to the IAEA Publications Committee (IAEA, 2003d) for approval. There has been a continuing evolution in IAEA standards. Revised safety standards were promulgated by the IAEA in 1999 (IAEA, 1999b) and revised Fundamental Safety Principles (SF-1) were released in 2006 (IAEA, 2006c).

The various types of IAEA safety documents, which the Agency ranked hierarchically in 1989 following the major, post-Chernobyl expansion of its nuclear safety activities, are:

20 See www-ns.iaea.org/committees/.

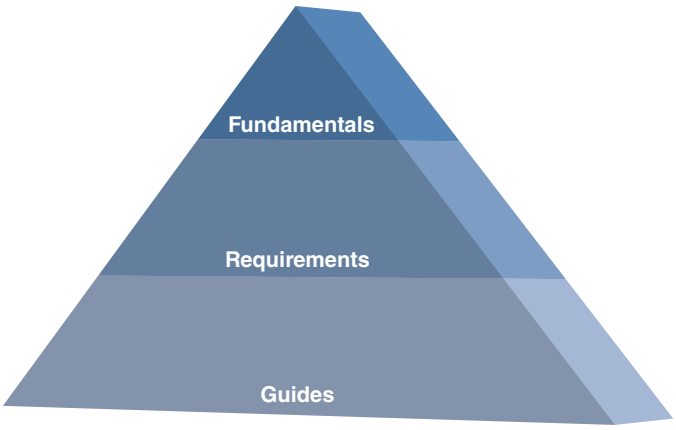
- Safety Fundamentals, which set out basic objectives, concepts and principles;
- Safety Requirements, which establish basic requirements that "shall" be fulfilled in the case of particular activities or applications; and
- Safety Guides, which contain recommendations based on international experience that "should" be followed in fulfilling the Safety Requirements (Gonzàles, 2002: 280-281; 295-297).

Table 1: IAEA Fundamental Safety Principles

Responsibility for safety	The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks.
Role of government	An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.
Leadership and management for safety	Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks.
Justification of facilities and activities	Facilities and activities that give rise to radiation risks must yield an overall benefit.
Optimization of protection	Protection must be optimized to provide the highest level of safety that can reasonably be achieved.
Limitation of risks to individuals	Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.
Protection of present and future generations	People and the environment, present and future, must be protected against radiation risks.
Prevention of accidents	All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.
Emergency preparedness and response	Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.
Protective actions to reduce existing or unregulated radiation risks	Protective actions to reduce existing or unregulated radiation risks must be justified and optimized.

Source: IAEA (2006c: 5–16).

Figure 5: IAEA Safety Standards Series



Source: Adapted from Akira (2009: 214).

More than 200 safety standards have been negotiated under the auspices of the IAEA, focusing on four main areas:

- Basic Safety Standards and supporting documents (radiation safety/protection);
- Nuclear Safety Standards program, relating to nuclear facilities including reactors;
- Radioactive Waste Safety Standards program; and
- Transport Regulations and supporting documents (Gonzàles, 2002: 281).

The Agency also establishes guidelines and voluntary codes of conduct, such as its 1998 Guidelines for the Management of Plutonium (IAEA, 2004); its 2006 Code of Conduct on the Safety of Research Reactors (IAEA, 2006a) and its Code of Conduct on the Safety and Security of Radioactive Sources (IAEA, 2000a).

IAEA safety standards and codes are not legally binding on states. They are, however, binding on the IAEA itself in its own operations, and on states and the Agency when they are involved in joint projects. Nonetheless, according to the International Nuclear Safety Group (INSAG), the degree to which a state's safety requirements are expected to be in compliance with IAEA documents depends, "on the level of the publication in the hierarchy" (INSAG, 2006: 11). Safety Fundamentals (see Figure 5) "should not be amenable to significant changes over time, and they are expected to be met without exception." Such Fundamentals are cited, for instance, in the CNS. Safety Requirements, next in the hierarchy, "should be met by new facilities and related new facilities and are a target that should be met over a period of time that is reasonable for existing facilities and practices." Finally, Safety Guides "are practical guidance on achieving state-of-the-art nuclear safety"; meeting them is "recommended unless alternative means can be taken to provide the same level of safety." In his last speech to the UN General Assembly before his retirement in December 2009, ElBaradei went so far as to call for IAEA safety standards to be "accepted by all countries and, ideally, made binding" (ElBaradei, 2009), although whether they should be binding in international law or in national legislation was not made clear.

In response to widespread calls for the IAEA's nuclear safety standards to be revisited after Fukushima, DG Amano announced at the June 2011 Ministerial meeting that he had asked the CSS to review the standards and report, within 12 months, recommendations for strengthening them (Amano, 2011b: 2). He suggested that particular attention be paid to a number of severe hazards, such as tsunamis and earthquakes, including preparedness for prolonged blackouts, the assured availability of water for cooling, special protection for plants with multiple reactors, and the cooling of spent fuel under severe accident conditions. The post-Fukushima Action Plan added: regulatory structure; emergency preparedness and response, nuclear safety and engineering (site selection and evaluation, management of severe accidents, loss of heat sink, accumulation of explosive gases, nuclear fuel behaviour and ways to ensure the safety of spent fuel storage) (IAEA, 2011j: 4).

Implying dissatisfaction with the speed of past revision exercises, the Action Plan called for "using the existing process in a more efficient manner" and according to a "prioritized sequence." Presumably in an effort to address this criticism, the Secretariat has established a Safety Standards Review Task Force, which has developed a draft Safety Standards Action Plan specifically to review the IAEA Safety Standards (IAEA, 2011q: 4). The review will cover, as a first priority, the set of Safety Requirements, particularly those applicable to nuclear power plants and storage of spent fuel. The plan also includes "options" for a more efficient revision process. The CSS adopted the Secretariat's plan in September 2011, while noting that it will be a "living" document, subject to continuous updating as new lessons are learned from Fukushima. A draft report on the review

of the IAEA Safety Standards was submitted to the CSS in March 2012, after prior consideration by the Safety Standards Committee.

INSAG

INSAG is a group of experts, appointed by the DG, with high-level professional competence in the field of safety, drawn from regulatory organizations, research and academic institutions and the nuclear industry. Originally constituted as the International Nuclear Safety Advisory Group in 1985 to provide advice to the DG on the safety of nuclear power plants, it has become a forum for the exchange of information and views, and has sought to formulate common safety concepts, including initial suggestions for the CNS peer review process.

In 2003, the group's name was changed to the International Nuclear Safety Group (the acronym INSAG was retained) to emphasize that it would now serve not only the IAEA, but the international community more broadly, including nuclear design organizations, nuclear power plant operators, national regulatory authorities, vendors and other stakeholders, notably members of the public interested in nuclear issues and the environment (INSAG, 2006: 3). Its objective remains to provide guidance on nuclear safety approaches, policies and principles. Its reports are published as IAEA documents.[21] In 2006, INSAG sought, for the first time, to define the global nuclear safety regime and make recommendations for strengthening it (INSAG, 2006). The post-Fukushima Action Plan benefitted from the contribution of INSAG, in the form of a so-called Letter Report to the Director General (INSAG, 2011), which made various recommendations about improving nuclear safety in light of the disaster.

IAEA/NEA International Reporting System for Operational Experience

The IAEA/NEA International Reporting System for Operational Experience (IRS) is meant to be used to report unusual events, such as unplanned shutdowns in nuclear power plants that may have safety or accident prevention implications. (Catastrophic accidents are supposed to be reported through much faster means.) It was started by the NEA for its membership in 1996, and was extended to encompass IAEA members in 1983. Since 2006, the reports filed have been available through the web-based Incident Reporting System. Currently, all 31 countries that operate nuclear reactors, plus Italy, participate. Through the IRS, information is collected from participating national regulators. The information is assessed, analyzed and fed back to operators, with the goal of preventing similar occurrences at other plants. The IRS is also concerned with identifying "precursors," events of apparently low safety significance, which, if not properly attended to, have the potential to escalate into more serious incidents. Through its study of such events, the IAEA seeks to use the IRS to accelerate the identification of event precursors. The value of the IRS is enhanced through topical studies on particular problems, annual meetings of national coordinators and a joint annual IAEA/NEA meeting to exchange information on unusual events.

One drawback of the IRS is that reporting is voluntary. While some countries are active in reporting to the IRS, others never file reports. In 2006, the IRS received just 80 reports, compared to 1,000 for a similar reporting system operated by the World Association of Nuclear Operators (WANO), an organization of state and commercial operators of nuclear power plants. Richard Meserve, the chairman of INSAG, told the INSAG Forum in Vienna in September 2007 that regulators are not reporting enough incidents to the IRS, nor are they providing enough information on how they have used the operating experience of others (MacLachlan, 2007: 10). He warned that the international nuclear community needs to do much more to collect, analyze and disseminate feedback from plant operating experience, lest failure to learn from past experience "serves to derail" the "promise of nuclear power." In fact, the failure of states to report and share experience could be regarded as non-compliance with the CNS, which requires parties to "take the appropriate steps to ensure that… existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies" (IAEA, 1994: Art. 19(vii)). It should be noted that Japan has regularly reported incidents at its nuclear power plants, some of which were quite significant.

International Seismic Safety Centre

The International Seismic Safety Centre (ISSC) was established in September 2008 in response to the July 2007 earthquake that damaged Japan's seven-unit Kashiwazaki-Kariwa nuclear power plant, the world's largest. The quake exceeded the level of seismic activity taken into account in the facility's design parameters, focusing international attention on the vulnerability of nuclear reactors to seismic events, and underlining the need for international collaboration. Mandated to consider not just hazards from seismic events, but also from volcanoes, tsunamis, tornadoes and floods, the ISSC seeks to promote the sharing of knowledge, support states through advisory services and training courses and enhance safety by utilizing experience from previous events. A scientific committee of experts from academia, industry and nuclear safety authorities advises the ISSC.[22] Japan and the United States contributed start-up funds for the centre, which had an initial staff of seven, but has now been boosted with experts on short-term contract.

From the outset, one urgent task has been to update the IAEA's seismic safety guides, which have only been revised three times in the past 35 years (US, 2008). A new guide on seismic evaluation

21 Available at: www-ns.iaea.org/committees/insag.asp.

22 Experts have been nominated from seven specialized areas: geology and tectonics, seismology, seismic hazard, geotechnical engineering, structural engineering, equipment and seismic risk.

of potential sites for nuclear power plants to accompany existing guidelines on seismic hazard and design, was being worked on when the Fukushima event struck. For existing nuclear power plants, the ISSC is developing updated guidance for regulators and operators to use in evaluating seismic safety (Kaiser, 2012). The Centre also conducts Safety Review Services, such as a Siting and External Events Design review, designed to determine whether a state's site selection and plant safety design is consistent with international practice, and to confirm that conclusion through international peer review.

The ISSC is currently also assessing volcanic hazards when siting a nuclear power plant. This work will result in a guide, due to be issued in 2012, supplemented with training courses and a workshop. In partnership with the US National Oceanographic and Atmospheric Administration, the ISSC is, in addition, developing a real-time tsunami forecasting system. Since sabotage could cause similar effects to a natural event, an ISSC working group is also producing a manual to help IAEA member states implement security guidance to prevent sabotage.

IAEA Assistance to Member States in Ensuring Nuclear Safety

The IAEA has an impressive array of programs to help states in improving nuclear safety, including: providing safety-related assistance; fostering safety-related information exchange; promoting safety-related education and training; coordinating safety-related research and development; and rendering safety-related services. Much of this is directed at developing countries, to improve their safety performance across a broad range of nuclear and radiological areas, falling mostly under the Technical Cooperation program (see page 86). Of particular relevance to states seeking nuclear energy for the first time is the Agency's "Integrated Strategy for Assisting Member States in Establishing/Strengthening Their Nuclear Safety Infrastructure." This involves a joint review by the IAEA and the state, to identify areas where safety falls short of the reference situation and where assistance could be most effectively applied. In addition, the Agency provides Integrated Nuclear Infrastructure Review services for states seeking to embark on a nuclear power program for the first time; the nuclear power national infrastructure evaluation methodology for these reviews is being updated by the Secretariat to take into account the lessons of Fukushima (IAEA, 2011q: 6).

A large portion of the Agency's work in nuclear and radiological safety is the provision of review services to states, at their request. The most significant of these are considered briefly below, but it is beyond the scope of this study to comprehensively assess their effectiveness. The post-Fukushima Action Plan, in most cases, did not make specific recommendations about strengthening these services, rather it simply told the Secretariat to incorporate lessons learned and to "assess and enhance as necessary" (IAEA, 2011j: 3), and for member states to use such services more regularly, albeit still on a voluntary basis. The Action Plan also asked the Secretariat to compile information on where and when all such missions had occurred, indicating that this type of information was not readily available (this project has had continuing difficulties in accessing such information from the IAEA website and reports).

In the wake of Fukushima, IAEA member states were asked to "undertake a national assessment of the design of nuclear power plants against site specific extreme natural hazards and to implement the necessary corrective actions in a timely manner" (IAEA, 2011j: 2). Many of them did so in the form of "stress tests." Responding to member states' requests, in short order the Secretariat developed a *Methodology for Member States to Assess the Safety Vulnerabilities of Nuclear Power Plants against Site Specific Extreme Natural Hazards*, released on November 16, 2011. The Agency is also prepared to provide assistance and support, and even organize peer reviews of national assessment (IAEA, 2011j: 2). Japan has taken advantage of this offer. In a striking precedent, South Africa asked the Agency to conduct stress tests on its behalf, whereas states normally conduct their own stress tests, perhaps using the IAEA's methodology. The Agency has also been tasked by the post-Fukushima Action Plan to organize international meetings to analyze all relevant technical aspects and draw lessons from Fukushima.

IAEA NUCLEAR SAFETY REVIEW SERVICES

- Operational Safety Review Teams (OSART)
- Peer Review of Operational Safety Performance Experience (PROSPER)
- Integrated Regulatory Review Service (IRRS)
- Safety Culture Assessment Review Team (SCART)
- Periodic Safety Review (PSR)
- International Regulatory Review Teams
- Engineering Safety Review Services
- International Probabilistic Safety Assessment Review Teams
- Review of Accident Management Programmes
- Transport Safety Appraisal Service
- Various radioactive waste management services[40]

23 The Agency's Disposable Waste Unit, which develops the standards dealing with radioactive waste, also assists states in their application. One means is by undertaking a peer review by a team of international experts who visit to assess and make recommendations regarding the applicable safety standards of the requesting state. Subsequently, the IAEA may offer technical assistance to facilitate implementation.

Operational Safety Review Teams

The Operational Safety Review Teams (OSART) program, established in 1982, is designed to aid IAEA member states in improving the operational safety of their nuclear power plants. At the request of a member state, teams of international experts will conduct three-week intensive reviews of a nuclear facility.

The scope of the reviews is wide, covering management goals and practices, organization and administration, training and qualifications of personnel, operations, maintenance, technical support, operational experience feedback, radiation protection, chemistry and emergency planning and preparedness. This allows nuclear experts and power plant operators from one country to assist power plant operators in another, through the sharing of information and international best practices. Not all of OSART's work is remedial: an important aspect is to identify strengths that can be shared with other states and are then fed back into the Agency's work to improve safety standards.

OSART missions arrive at a plant site already familiar with its main features, operating characteristics, history, regulatory provisions, technical specifications, procedures, organization and key personnel, as a consequence of an Advance Information Package prepared by the IAEA Secretariat in consultation with the receiving state's authorities (IAEA, 2005c: 11 and 13). After the initial visit, a follow-up review is conducted one year to 18 months after the initial mission. An IAEA database indexes the results of all missions and follow-up missions, noting recommendations, suggestions, and strengths and weaknesses. The first OSART mission was in August 1983 to the Ko-Ri nuclear power plant in South Korea. Since then, there have been more than 165 missions, carried out at 106 nuclear power plants in 33 countries (IAEA, 2011v). Although the regulator of the member state is meant to bear the costs of the mission, many developing country missions are funded by the TC program.[24]

While OSART teams purportedly "do not attempt to assess a plant's adherence to national regulatory requirements or a plant's overall safety," on the assumption that the plant meets the safety requirements of the host country (IAEA, 2005c: 6), they are, in effect, doing so by identifying areas for improvement in conformity with IAEA safety standards and proven international performance and practices. OSART missions are, therefore, a useful lens through which to view the safety performance of the nuclear industry.

The outcome of OSART missions has typically been considered very good, with most operators scoring high grades for their safety performance. A mission usually yields between 20 and 30 recommendations. Nuclear operators have, thus far, received OSART recommendations positively: between 40 and 50 percent of issues are resolved by the operator within a year, with satisfactory progress eventually being achieved for 96 to 97 percent.[25] Restrictions on OSART reports are removed 90 days after their official distribution to the host country, unless otherwise requested. Many host countries and plants post their OSART reports on their websites to enhance transparency (IAEA, 2005c: 9). Of the countries with operational power reactors, only Taiwan has not hosted an OSART mission to at least one of its plants so far, or is not planning one in the future. However, not all power reactors in all countries have, to date, been subject to an OSART mission. Armenia, which has a reactor that is considered to be one of the least safe in the world, and which had not previously hosted an OSART mission, finally did so in June 2011, presumably prompted by the shock of Fukushima. DG Amano reinforced the safety message with a visit to Armenia in April 2012. India is planning its first OSART mission in 2012, to a reactor in Rajasthan, while Iran is planning to host an OSART mission to its newly inaugurated Bushehr reactor in 2013.

The post-Fukushima Action Plan recommends that each state with nuclear power plants host at least one OSART mission during the next three years, with the initial focus on older nuclear power plants. Thereafter, OSART missions are "to be voluntarily hosted on a regular basis" (IAEA, 2011j: 4). This is the lowest common denominator outcome of negotiations by member states concerning the most contentious part of DG Amano's original draft — a proposal for a commitment by states to random, voluntary peer reviews of one-tenth of the world's reactors over three years (approximately 44). Some member states, including Germany and Russia, wanted a mandatory peer review system, while other influential states such as China and Japan were opposed. Crucially, the United States was also opposed, apparently on the legal advice of State Department lawyers, rather than due to resistance by the NRC.[26] The US-based Institute of Nuclear Power Operators (INPO) was also opposed, because of the number of US reactors that would be affected. Even Amano's modest system would reportedly have taken a year to 18 months to introduce, and would require an estimated doubling of the budget for such reviews. There was also the question of where the Agency would find the personnel to organize and supervise such reviews. The industry itself would have struggled, since it is often experienced senior officials that are most sought after and valuable in conducting peer reviews.

Although the OSART program overall seems sound and useful, it has its limitations. One is that states are not required to include OSART outcomes in their national reports under the CNS, although some do. This should be made a requirement. The system could be further enhanced by collaboration with the WANO in its industry-led peer review process. WANO is a non-profit member association established in 1989 by the world's nuclear power operators. Its members operate some 440 nuclear units in more than 30 countries.[27] The post-Fukushima Action Plan enjoined the IAEA Secretariat to "strengthen cooperation with WANO by amending their Memorandum of Understanding [MoU] to enhance information

24 http://tc.iaea.org/tcweb/publications/projectprofiles/NSNI_OSART-OperatnlSafety.pdf.

25 Private meeting with an IAEA official, October 2008.

26 Personal communication with the author.

27 For further analysis of WANO, see Trevor Findlay, 2010a: 37–40.

exchange on operating expertise and on other relevant safety and engineering areas" (IAEA, 2011j). Until now, the Agency's cooperation with WANO focused on: sharing information; attending each others' workshops and meetings; and participating in some expert meetings together.

DG Amano attended WANO's biennial general meeting in Shenzhen, China, in October 2011 and welcomed greater WANO participation in IAEA activities, particularly in the development of IAEA Safety Standards (IAEA, 2011q: 4). Noting that WANO, as a representative of reactor operating organizations, is in a position to provide valuable input into standards, he invited it to attend meetings of the Nuclear Safety Standards Committee as "an observer." That it took a disaster like Fukushima to induce this offer is an indication of how far removed from the industry the Agency, as an organization of states, has been. Amano also said the two organizations should continue to exchange information on the results of their respective peer review activities ("where confidentiality constraints permit"), and improve coordination of the timing of their missions to ensure they do not occur to closely together (IAEA, 2011q: 4). At the time of writing, the two organizations were still negotiating their MoU amendment. In addition, it would also be useful for the Agency to collaborate with the INPO, whose peer reviews are widely held to be more effective than the rather variable regional approach that WANO's takes.

It is not clear how far IAEA cooperation with such industry bodies will be taken, but ultimately, consideration should be given to joint IAEA peer review processes, including site visits, in order to avoid duplication of effort and to enhance the synergistic effect of their respective lessons-learned mechanisms. WANO has moved to strengthen its peer review process and the organization as a whole by establishing a Post-Fukushima WANO Commission (WANO, 2012). Its recommendations were adopted at its October 2011 meeting in Shenzhen, China, and, if implemented would enhance any strengthened collaboration that eventuates with the IAEA (NucNet, 2011). It is notable that the IAEA rates only one brief mention in WANO's 2011 annual report (WANO, 2012). WANO has, however, indicated that it is examining whether the IAEA's OSART missions could serve as a substitute for WANO peer reviews, where appropriate.

Given the Fukushima disaster and the potential increase in the number of reactors worldwide, the Agency should be given more resources for an expanded OSART program. Considering the time-consuming nature of the OSART process and future increased demand, one could envisage the IAEA establishing a dedicated cadre of experts in the various reactor types and technologies, including new generations, to permit expansion of the program.

Integrated Regulatory Review Service

The Integrated Regulatory Review Service (IRRS), established in 2006, aims to provide advice and assistance to member states, in order to enhance the effectiveness of their regulatory infrastructure. Importantly, it requires the state to first provide a self-assessment of how, in regulatory terms, it is complying with the CNS and the Joint Convention. These reports are subject to extensive peer review, providing the opportunity for "open and frank discussions on trends, challenges and best practices" (IAEA, 2009d: 4). The requesting state decides on the scope, which may range from a discrete regulatory issue to consideration of its entire regulatory regime. The process includes site visits, interviews and documentation review. The Secretariat reported in November 2011 that there had been 31 IRRS missions conducted to that point, with between three and six typically conducted each year (IAEA, 2011q).

Canada hosted an IRRS mission in 2009 in response to an "action" requested of it by other countries at the third CNS review meeting (CNSC, 2007: 3).[28] The exercise was reportedly intense, thorough and essentially a clause-by-clause audit of Canada's regulatory system matched to IAEA principles and guidelines. Vietnam, a potential new entrant in the nuclear power business, also hosted an IRRS mission in 2009, even though it currently does not have an operating nuclear reactor.

The post-Fukushima Action Plan directed the Secretariat to enhance IRRS through a more comprehensive assessment of national regulations against IAEA Safety Standards. Each member state with nuclear power plants was enjoined to "voluntarily host" an IRRS mission "on a regular basis," and conduct a follow-up mission within three years (IAEA, 2011j: 4). In October 2011, the US NRC, in cooperation with the IAEA Secretariat, hosted a workshop in Washington, DC, on lessons learned from the IRRS missions carried out over the past four years. Attending the workshop were about 60 senior regulators from 22 member states. The workshop endorsed the value of the service as a "powerful tool for regulatory improvement, disseminating good practices, increasing public confidence and initiating international exchange of experience" (IAEA, 2011q: 3). Meanwhile, participants commended a specific Fukushima module, which has been incorporated into the scope of IRRS missions to take account of the initial regulatory implications of the accident and will be updated as further lessons are learned. At the meeting, it was concluded that the Agency needs more resources to meet the current and future demand for IRRS missions.

One of the lacunae of global nuclear governance is the lack of a truly international body of nuclear regulators. Senior regulators meet annually at the IAEA's annual GC, and regulatory issues are considered at other venues, including at CNS review meetings. But the GC meetings, while well attended, last only a day and involve general discussion on only two themes. There are also regional and reactor-type networks of regulators to supplement the international regime (Findlay, 2010c: 55). The only international body devoted to nuclear regulators, which also sounds like it is intended to be universal, is the International Nuclear Regulators Association. Established in 1997, it is in fact a small self-nominated "club" of like-minded senior regulators from Western states, plus Japan and South

28 For the results and the CNSC management's response see: www.nuclearsafety.gc.ca.

Korea. Thus, it only includes eight of the 31 national nuclear power plant regulators. The IAEA should encourage the establishment of a truly international regulators body as a means to strengthen nuclear regulation worldwide, and to act as an interlocutor with the Agency on such matters as IRRS missions, and nuclear regulation generally.

Peer Review of the Effectiveness of the Operational Safety Performance Experience Review

Launched in 2000, Peer Review of the effectiveness of the Operational Safety Performance Experience Review (PROSPER) provides advice and assistance to member states in developing and managing their operational experience feedback process. It therefore helps actualize the vague requirement of the CNS for its contracting parties to report reactor operating experience and how it is used, in combination with experience from other operators, in order to improve their performance.

A PROSPER mission visits a reactor operator and considers what effective management practices, sound policies and procedures exist, the comprehensiveness of available instructions, the existence of adequate resources, and the overall capability and reliability of plant personnel (IAEA, 2003e). If the feedback process does not meet with internationally accepted best practice, improvements are suggested. The findings and corresponding corrective actions are reported to the national regulatory body. Additionally, a follow-up mission, at the request of the state, is conducted within 18 months to assess whether and how the PROSPER recommendations have been implemented. No details are publicly available on which states have used the PROSPER service. No mention was made of PROSPER in the Action Plan on Nuclear Safety.

Safety Culture Assessment Review Team

There has been an increasing realization in recent years that engendering a robust safety culture is a key component of nuclear safety at nuclear power plants and other nuclear facilities. The aim of Safety Culture Assessment Review Team (SCART) missions is to provide advice and assistance to member states in the form of an in-depth independent review of s*afety culture* at a particular nuclear facility, to enhance the safety culture of the operators of that facility. SCART missions may be requested by various kinds of nuclear facilities in any stage of development — during commissioning, operation or decommissioning.

Periodic Safety Reviews

In many countries, Periodic Safety Reviews (PSRs) are conducted by nuclear power plant operators, which are in turn reviewed by the national regulator. The IAEA may be invited to review the conduct of a PSR. PSRs are seen as additional to routine reviews of nuclear power plant operation and special reviews following major events of safety significance (IAEA, 2003d: 1). PSRs aim to assess the cumulative effects of plant aging and plant modifications, operating experience, technical developments and aspects of siting. The reviews include an assessment of plant design and operation against current safety standards and practices. The objective is to ensure a high level of safety throughout the plant's operating lifetime. The Agency recommends that PSRs be conducted every 10 years.

The PSR is already a part of the mandatory regulatory system in some states, but other states prefer alternative arrangements such as a systematic safety assessment program or a safety review that deals with specific safety issues, significant events and changes in safety standards and practices as they arise (IAEA, 2003d: 3-4). While the IAEA does not discourage these, it suggests that any alternative should demonstrate that it is able to satisfy the objective of a PSR. The 2003 IAEA guide to PSRs is currently undergoing revision.[29] In the meantime, the Agency issued a document in 2010 that describes alternative methods of conducting PSRs, based on the experience of member states (IAEA, 2010b). The Agency has, in addition, established a web-based platform to support member states with advanced reactor safety assessment training methods, including training simulators. The post-Fukushima Action Plan did not specifically mention PSRs.

Re-thinking the Nuclear Safety Regime?

IAEA member states and the nuclear industry have consistently argued that nuclear safety is so critical and important that it should be left to them to handle, and the only role the international regime should have is in recommending, facilitating and assisting. The assumption is that no other industries are comparable to theirs in terms of safety and security sensitivity, vital national interests and international competitiveness. In fact, there is another industry, international civil aviation, which has certain similarities and the nuclear industry may be able to learn from it.

The International Civil Aviation Organization (ICAO), civil aviation's equivalent to the IAEA, has moved to modernize its approach to safety since 1994 (Shull, 2011).[30] Called the Universal Safety Oversight Audit Programme, it aims to assess how well its members have implemented ICAO safety procedures and standards, and to offer advice to members to help them comply. It involves a series of mandatory universal audits with follow-up actions to ensure that progress is being made. Currently, ICAO is transitioning to an even more impressive system, involving continuous "real time" monitoring of each member state's compliance with ICAO safety standards. When fully implemented, it will involve a continuous flow of information to ICAO headquarters in Montreal, Canada, from states themselves, internal stakeholders and external stakeholders. Impressively, the system has resulted from a consensus-building approach among member states over several years.

29 Information from Canadian Nuclear Safety Commission (CNSC), Ottawa, November 2009.

30 I am indebted to Aaron Shull for his study of the comparisons between ICAO and the IAEA that was commissioned for this report. See also Mackenzie (2010).

There are clearly some differences between international civil aviation and the nuclear energy sector. Aircraft move between countries, rather than being stationary like nuclear power plants. Commercial aircraft, once they are sold, unlike nuclear reactors, are not considered "commercial confidential." An accident involving one or two aircraft could never approximate the scale of a major nuclear accident. Nonetheless, the similarities are striking: both industries involve a high degree of government regulation, both are fiercely competitive (at least in terms of new nuclear reactor sales), both are increasingly internationalized, involving multinational companies that span several continents, both require public trust to operate, and accidents in both can potentially have effects beyond national boundaries.

There are also similarities and differences between ICAO and the IAEA. As specialized international bodies, both have broad political and technical mandates in terms of their respective areas of expertise. The ICAO Council is similar to the IAEA's BoG in that both approve safety standards. However, the major difference is that the ICAO Council has the authority to incorporate airline safety standards as Annexes to the Convention on International Civil Aviation. According to some legal opinions, these then become legally binding on states parties (Shull, 2011). The IAEA BoG has no such authority and there is, currently, no mechanism for attaching such annexes to the CNS, other than by amending the treaty through negotiations among states parties. IAEA safety standards are recommendatory, even though adopted by the BoG. Nonetheless, even without legally binding standards, the IAEA could investigate establishing a system that emulates the Universal Safety Oversight Audit Programme as part of its current attempts at post-Fukushima reform. In particular, the transmission of data on a continuous basis to the Agency on the safety (and security) status of nuclear power plants would be worth consideration, as is already being contemplated for global radiation monitoring. Member states could volunteer to inaugurate such a system in the same way that it initially took volunteer states to inaugurate nuclear safeguards.

CONCLUSIONS

The Agency's own assessment is that, over the past two decades, there has been a clear trend towards strengthening the international nuclear safety regime (UN, 2011c: 16):

> International cooperation has increased and countries considering the introduction of nuclear power programmes have been encouraged to apply IAEA safety standards and relevant international instruments. Other developments have included increased regional harmonization and cooperation, steadily improving safety performance indicators…greater openness and transparency and increased synergy between safety and security. There has also been an increasing number of requests for IAEA expert peer review services in such areas as regulation, operational safety, emergency preparedness and security, as well as a greater focus on issues such as safety management and leadership.

While this is true, Fukushima has demonstrated that it is far from sufficient. In particular, since Fukushima it has been widely recognized, including by the UN and the IAEA and its member states, that there is a need for expanding the role of the IAEA in: receiving and disseminating information, especially in the event of accidents and incidents; assisting states in peer review; and in expanding the range of services it renders to help states improve their nuclear safety performance. Critically, though, the IAEA can prepare, advise and assist all it wishes, but it is still only able to act in its "central coordinating role" during an actual crisis with the permission of its member states, as was starkly demonstrated by Fukushima.

While the post-Fukushima Action Plan is, regrettably, not legally binding, it does contain useful first steps. Its characterization as a "Draft" indicates a willingness to periodically review and strengthen it. The Action Plan also creates awareness among member states, the rest of the international community and among other stakeholders. Peer pressure and outside pressure can be framed in the context of the Action Plan. Although incrementalism is likely to characterize the evolution of the IAEA's role in nuclear safety in the short term, in the longer term, member states need to seriously consider making IAEA standards mandatory and giving the Agency the power to monitor compliance with them — in the same way that it does for nuclear safeguards.

RECOMMENDATIONS: SAFETY OF NUCLEAR FACILITIES AND MATERIALS

- The IAEA and its member states should implement their post-Fukushima Action Plan, which should be constantly reviewed in light of further analysis of the Fukushima tragedy — this will require leadership from the BoG, the DG and member states.
- In the 2012-2013 budget, increased funding should be allocated to implement the Action Plan as the priorities become clearer.
- The IAEA should begin to implement an integrated approach to nuclear risk management, governance and emergency arrangements, as recommended by the World Institute for Nuclear Security (WINS) (WINS, 2011).
- The CSS should complete its review of IAEA nuclear safety standards as promptly as possible.
- The DG should continue to pursue options for mandatory IAEA-led peer review, but in the meantime take steps to ensure that such reviews become the norm; member states supportive of such reviews should volunteer for them to set an example.
- The Secretariat should increase its own role in OSART and other peer reviews, and states should provide funding to increase the Agency's capacity to do so.
- The Agency should pursue greater cooperation with WANO and INPO, including mutual sharing of information and even joint peer reviews.
- The IAEA should convene an international regulators meeting to establish a truly global body of regulators that would meet regularly.
- The Agency should, in addition, lead efforts to establish a global nuclear safety network involving all stakeholders, including industry, academia and civil society.
- The IAEA, or an outside body, should commission a study that examines the ICAO safety model for international civil aviation and whether any lessons can be drawn for nuclear safety monitoring and implementation.

A close-up of the protection fence around the Temelin nuclear power plant (Czech Republic). (IAEA Photo by Vadim Mouchkin)

PART FOUR: NUCLEAR SECURITY

Security affects the nuclear industry in a way that it does not affect other forms of energy generation. This is partly a legacy of the highly secretive nuclear weapons programs from which civilian applications of nuclear energy emerged. It is also due to the strategic nature of the facilities and nuclear materials involved. Large nuclear power plants or other nuclear facilities have, traditionally, been considered tempting targets for military or terrorist attacks or saboteurs, because they often supply large amounts of electricity and because an attack could produce severe radiological effects.

The issue of nuclear security has been thrust to the forefront of international concern by the terrorist attacks of September 11, 2001 (9/11), even though those attacks had no nuclear component. The audacity of the international conspiracy that led to 9/11 has heightened awareness about two particular threats: the potentially catastrophic effects of a terrorist attack on a nuclear reactor or other nuclear facility, in effect using it as a radiological weapon; and the possibility that a well-organized and well-funded group like al-Qaeda might seize nuclear material from the civilian nuclear fuel cycle for a nuclear weapon or radiological weapon — also known as radiological dispersal devices (RDDs) — and might actually be able to use it for that purpose. Paradoxically, it took a non-nuclear event like 9/11 to raise awareness about both types of threat, without the world having to experience the nuclear security equivalent of Chernobyl.

Nuclear security has assumed a much higher profile in the activities of the IAEA since 9/11. The Agency created its Office of Nuclear Security in 2002 under the Department of Nuclear Safety and Security. In March 2002, the BoG approved in principle its first Five-Year Nuclear Security Plan. Given that this is a relatively new concern for the IAEA, the Agency is still "feeling its way." There are several reasons for its cautiousness.

The first is the sensitivity of member states concerning their sovereignty and confidentiality, both state and corporate. Since nuclear security and radiological protection measures necessarily

involve key national functions such as law enforcement and control over access to information, states are "understandably reluctant to expose their sovereign security and law enforcement practices to external scrutiny, let alone anything resembling external regulation" (IAEA, 2003c: 145). Moreover, as Matthew Bunn points out, "any test or assessment that revealed particularly urgent vulnerabilities would be especially closely held" (Bunn, 2009: 115). As the Agency makes clear from the opening paragraphs of its annual "Nuclear Security Report" for 2011, it recognizes that "responsibility for nuclear security rests entirely with each State" (IAEA, 2011u: para. 2). This is not a refrain heard in the nuclear non-proliferation and safety areas.

The Agency's caution has been heightened by the officially skeptical attitude towards nuclear security adopted by the NAM, which sees the possession of nuclear weapons by states as the greatest threat; worries that an IAEA emphasis on nuclear security might detract from its core mandates; and fears that there will be a consequent reduction in funding for technical cooperation and peaceful uses (Potter and Mukhatzhanova, 2012: 124-125). The developing countries insist that additional activities conducted by the Agency should be funded by voluntary contributions, not from the regular budget. Notwithstanding this, many NAM countries have sought Agency assistance in strengthening their national nuclear security arrangements.

Second, the Agency is also struggling in carving out a prominent role in nuclear security as this requires involvement with a whole new set of stakeholders — comprising the security sector — with which the IAEA has, historically, had no familiarity. Such stakeholders range from international organizations such as INTERPOL, the World Customs Organization, the Police Community of the Americas (AMERIPOL) and the Organization for Security and Cooperation in Europe, to state security organizations, national intelligence organizations, military and paramilitary forces, police, plant operators and commercial security companies.

A third challenge for the Agency is that the global governance regime for nuclear security is nowhere nearly as extensive, advanced or coherent as the regime for nuclear safety; it is more fragmented and not nearly as Agency-oriented. There is no single, comprehensive legal instrument, like the NPT in the non-proliferation realm, but several lesser ones, all of which need to be adhered to and implemented by states if nuclear security is to be ensured. The main concern has been with physical protection ("guards, gates and guns"), rather than nuclear security in its entirety. There are also less detailed and widely accepted sets of recommended security principles and practices than in the nuclear safety field, little collaboration between nuclear plant operators worldwide, as in the case of nuclear safety, practically no peer review and an abiding sense that nuclear security is too sensitive an issue to be subject to global governance. As Roger Howsley puts it, "The pervasive secrecy surrounding nuclear security means that no global mechanism is in place to identify the worst security performers and help them come up to the level of the best performers" (Howsley, 2009: 204).

A final challenge is that other international processes relating to nuclear security are at play outside the Agency's orbit. In recent years, the major driver of enhanced global governance in the nuclear security field has not been the IAEA, but rather the nuclear security summit process. This was initiated by US President Obama in 2010, at the first summit held in Washington, DC, and followed in March 2012 by a second summit in Seoul, South Korea. A third is to be held in the Netherlands in 2014. Other US-led initiatives such as its various Cooperative Threat Reduction programs, bilateral arrangements, the US/Russia Global Initiative to Combat Nuclear Terrorism and other limited membership multilateral arrangements such as the G8's Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, have overshadowed the Agency role. This is due to their immediacy, high political profile, headline-grabbing nature and the availability of vastly bigger budgets. Although the IAEA is often invited to these initiatives to either brief participants or to participate, its role is clearly subordinate and secondary. In the non-governmental area, WINS has emerged as a small, but increasingly active, player. Nonetheless, the IAEA clearly has a role to play that no others can, and as the other short-term initiatives fade (it has been suggested that there will not be a fourth nuclear security summit), it may take a more central role.

As in other nuclear matters, the IAEA plays a crucial role in helping to implement the existing legal instruments concerning nuclear security, as well as advise and assist states in fulfilling their international and national obligations, notably, physical protection standards for both nuclear materials and facilities. It also holds conferences and workshops, conducts training, provides legal advice, facilitates research, and even provides equipment. In a 2007 review of the IAEA's nuclear security program chaired by Roger Howsley, WINS' inaugural director, it was concluded that "the IAEA security team is doing a fantastic job" (Howsley, 2009: 204). However, compared with its nuclear safety program, the Agency's nuclear security program is relatively small and, although resources have been increasing, it remains underfunded (Ferguson and Reid, 2009: 59).

IAEA ROLE IN TREATY IMPLEMENTATION

Compared to the NPT and the nuclear safeguards system, the IAEA's role in the implementation of nuclear security treaties is, on paper, relatively modest. However, as the Agency is the most important multilateral organization in the field, it has considerable potential influence, especially through its promulgation of nuclear standards pursuant to such treaties.

Convention on the Physical Protection of Nuclear Material

The only legally binding multilateral treaty in the nuclear security realm is the 1980 Convention on the Physical Protection of Nuclear Material (CPPNM). It was opened for signature in March 1980 and

entered into force in 1987. As of December 2011, the CPPNM had 145 states parties as well as EURATOM, and 44 signatories (IAEA, 2011h).

The purpose of the treaty is to commit states to ensure that nuclear material for civilian purposes under their jurisdiction is protected during international transport. It does this in three ways. First, it establishes legally prescribed protective levels for nuclear material during such transport. Annex 1 of the treaty sets out three categories of protection in descending order — from Category I (requiring the highest level of protection) to Category III (requiring the lowest). Second, it seeks to have states criminalize the theft of nuclear material. Third, it promotes international cooperation in prosecuting offences and responding in the event of a breach. The treaty does not apply to nuclear material for military purposes or radioactive sources. Each party must identify to all other parties, either through the IAEA or directly, a national point of contact with responsibility for the physical protection of nuclear material and for coordinating recovery and response operations in the event of a breach. If an incident occurs, parties are required to cooperate to the maximum feasible extent in the recovery and protection of nuclear material. The IAEA would, presumably, have a "clearinghouse" role in matching offers of assistance to needs, as is the case of the Convention on Assistance in Case of a Nuclear Accident, although this is not specified. Each party is obliged to report to the treaty depositary, presumed to be the IAEA (although strangely, the convention again does not make this clear), the laws and regulations it has adopted to implement the convention, and the depositary is obliged to transmit this information to all other states parties.

While the treaty contains provisions for review conferences every five years, which are organized by the IAEA at its Vienna headquarters, these are aimed at assessing the implementation of the convention as a whole, not the compliance of individual parties. There is no peer review mechanism for the treaty, as in the case of the CNS, nor does the IAEA have any particular role in this respect. Monitoring or verification of compliance is completely absent. There is the usual dispute resolution mechanism, involving referrals to the International Court of Justice, but these relate to interpretation of the treaty, not non-compliance. However, the IAEA does provide states, on request, with advisory, review and other services to help them assess and improve their compliance with the CPPNM.

CPPNM Amendment

Not long after the negotiation of the CPPNM, efforts were undertaken to strengthen the treaty, as it did not require states to protect nuclear material while in domestic use, storage or transport (unless transport crossed international waters or airspace). Hence, important aspects of the civilian nuclear industry were not covered by the Convention. In 1998, a group of experts convened by the IAEA to review all Agency programs recommended that consideration be given to revising the CPPNM to extend it to domestic use, storage and transport.

Negotiations on a CPPNM amendment stretched over many years, but were formally concluded at a diplomatic conference held in Vienna in July 2005. Undoubtedly, the endgame of the negotiations was stimulated by what some considered a nuclear "near miss" — the events of 9/11. The Amendment created a legally binding regime that requires each state party to the CPPNM to establish and maintain an "appropriate physical protection regime" for nuclear material in use, storage and transport, and for nuclear facilities anywhere under its jurisdiction. Such a national regime should be designed to prevent theft, establish a rapid response capacity to locate and recover missing or stolen nuclear material, protect against sabotage of nuclear material or nuclear facilities, and mitigate the consequences of any successful sabotage. Each party must embed the CPPNM in its legal system, establish a legislative and regulatory framework to govern physical protection, and designate a competent authority responsible for domestic implementation. Details of the point of contact should be imparted to all other parties and the IAEA.

Although the Amendment to the CPPNM was adopted in July 2005, it is not yet in force, as this is contingent on ratification by two-thirds of the original 112 state parties to the CPPNM. As of March 2012, there were 55 contracting states (IAEA, 2011c). Early entry into force is desirable as it will allow the IAEA to begin linking its advisory and expert services to compliance with nuclear security standards domestically, as well as during international transport. The Agency is actively encouraging more states to become party to the CPPNM in order to speed up entry into force of the amendment. In November 2011, it held a meeting on Facilitating Adherence to the 2005 Amendment to the CPPNM, which was attended by 55 states and EURATOM. However, the decision to sign the Amendment is the sovereign right of each member state, and the Agency had to acknowledge that "each State faced a different situation with regard to the ratification process" (IAEA, 2011u: 2). Regrettably, the United States, which has led the charge in recent years on nuclear security, has still not ratified the amendment. Canada, France and Pakistan are three other significant absentees.

Code of Conduct on the Safety and Security of Radioactive Sources

Unlike the security of nuclear facilities and nuclear materials, the security of radioactive sources has been considered in combination with safety. The implications of an accident or a terrorist incident involving radiological sources[1] became apparent following a fatal accident in Brazil in 1988, resulting from an "orphaned" medical source that killed several people, contaminated thousands more and severely affected the immediate environment (IAEA, 1988). It was not until a decade later, however, in 1998, that an international conference in Dijon, France impelled the IAEA GC to request the Secretariat to

1 Radioactive sources are used worldwide for a wide variety of peaceful purposes in industry, medicine, research and education, and in military applications. Some of these are securely contained in a suitable capsule or housing, but some are used in an unsealed form.

prepare a report on how national systems for ensuring the safety and security of radioactive sources could be operated effectively, and whether international undertakings could be formulated.

The Agency had published the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources in 1996, but these were binding only on states that chose to adopt them or were receiving assistance from the IAEA. Clearly, more action was needed. The Secretariat recommended an Action Plan approved by the BoG and GC in March 1999, which covers seven areas: regulatory infrastructures; management of disused sources; categorization of sources; response to abnormal events; information exchange; education and training; and international undertakings.

In terms of the last item, the major outcome was a non-binding international agreement, the Code of Conduct on the Safety and Security of Radioactive Sources. It provides guidance for ensuring the control of such sources, and for mitigating and minimizing any consequences should control measures fail (IAEA, 2000a). The Code embeds the Agency's standards and guides into international expectations of proper conduct in the area of radioactive sources, although it does not extend the Agency's powers beyond the advisory, educational and standard-building role that the Action Plan envisaged for it. In order to support states' implementation of the Code, although it is also not legally binding, supplementary Guidance on the Import and Export of Radioactive Sources, released in 2003, was developed by the Agency in response to the events of 9/11 (IAEA, 2003g). The new Guidance was seen as necessary to help prevent the malevolent use of radioactive sources, not just the accidental or inadvertent loss of orphaned sources that had been previously emphasized.[2]

As of January 16, 2012, 107 states had informed the DG of their intention to implement the Code, and 68 had indicated they were intending to implement the supplementary Guidance. The Code was reviewed at a November 2011 IAEA technical meeting to determine, among other things, how it might be enhanced with regard to security, but little resulted from the gathering. The status of the Code is also being reviewed, following calls by some member states for an internationally binding instrument on the safety and security of sources (IAEA, 2011x)

Paradoxically, the Agency's external auditor has castigated it for failing to insist that member states receiving radioactive sources from the Agency under its assistance programs comply fully with IAEA-recommended standards. The Agency's own Office of Internal Oversight Services (OIOS) has reported that the Agency does not comply with its own standards and remedial action is required urgently (IAEA, 2011a: 18 and 34).

International Convention for the Suppression of Acts of Nuclear Terrorism

The second major treaty in the nuclear security area for which the IAEA has some responsibility is the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) (UN, 2005). Negotiated at the United Nations between 1998 and 2005 on the initiative of Russia, the treaty was adopted by the UN General Assembly in April 2005, opened for signature in September 2005 and entered into force in July 2007. As of January 25, 2012, there were only 77 states parties and 115 signatories (UN, 2011a).

ICSANT establishes a wide variety of offences in relation to nuclear terrorism. It is an offence for anyone to possess radioactive material with the intent to cause or threaten to cause death, injury or damage to property or the environment, or use radioactive material in such a way that risks such consequences. Each party to the treaty is obliged to establish the offences within its domestic criminal law, ensuring that the penalties take into account the grave nature of nuclear terrorism. ICSANT also obliges parties to cooperate in preventing acts of nuclear terrorism by exchanging accurate information. Each party must establish jurisdiction over the offences, if they are committed on its domestic territory, on board a vessel or aircraft registered by the state, or when the offender is one of its nationals. ICSANT requires parties to either prosecute or extradite an offender, and to provide significant mutual legal assistance to each other in connection with criminal proceedings. ICSANT applies to all nuclear materials and facilities, including those used in civilian nuclear power programs.

Although the treaty names the UN Secretary-General rather than the IAEA DG as depositary and, therefore, it is not considered to be within the IAEA's "family" of treaties, the IAEA does assume several important treaty functions. Notably, if a state seizes control of any radioactive material, devices or facilities following the commission of an offence, that party must ensure, among other things, that they are held in accordance with IAEA nuclear safeguards and must "have regard" for IAEA "physical protection recommendations and health and safety standards" (UN, 2005: Art. 18.1). In doing so, the state party "may" call on the assistance of the IAEA. In addition, a state party disposing of or retaining seized radioactive material, a device or a nuclear facility is obliged to inform the IAEA DG "of the manner in which such an item was disposed of or retained" (UN, 2005: Art. 18.6).

The only other international nuclear security-related treaty that mentions a role for the IAEA is, oddly enough, the 1986 Treaty of Pelindaba, which creates an African Nuclear Weapon-Free Zone. Under Article 10 of the Treaty, states parties are legally obliged to apply measures of physical protection equivalent to those provided for in the CPPNM and IAEA security guidelines. While obscure, the Treaty is, nonetheless, important in setting a precedent that may be considered for other nuclear weapon-free zones. It is an example of how, by gradual accretion, the IAEA's standards can move towards global acceptance as universal norms.

2 See "Q & A: Safety and Security of Radioactive Sources" at: http://iaea.org/newscenter/features/radsources/radsrc_faq.html.

UN Security Council Resolution 1540

Although not a treaty, the other legally binding international obligation in the nuclear security realm involving the IAEA is UN Security Council Resolution 1540. Adopted in April 2004 under Chapter VII of the UN Charter, which makes it legally binding, Resolution 1540 obliges all states to refrain from providing support or assistance to non-state actors seeking to acquire so-called weapons of mass destruction (WMD) — normally taken to mean nuclear and radiological, as well as chemical and biological, weapons (Bosch and van Ham, 2007). The Resolution requires states to adopt and enforce appropriate and effective laws that prevent non-state actors from acquiring WMD or related materials and technologies. The Security Council has extended the Resolution three times, most recently in 2011, for 10 years (UN Security Council, 2011). In seeking better national measures to protect, among other things, nuclear and radioactive materials, the initiative is both a nuclear security and a non-proliferation measure.

The UN Security Council has established an implementation committee, the 1540 Committee, to monitor compliance by UN member states with the resolution and its successors. Supported by a small secretariat at UN headquarters in New York, it is also supposed to match requests for assistance in implementation with offers by other states to provide such assistance. In addition the committee is supposed to seek the assistance of relevant UN organizations already involved in such matters. The IAEA, after a rocky start, due to its fear that the Committee would be encroaching on its substantive territory, now recognizes that it is "an integral part of the international legal framework for nuclear security" (IAEA, 2011u: 3). The IAEA Secretariat is reportedly cooperating well with the Committee (IAEA, 2011u: para. 11).

The Agency is also cooperating with the UN's Counter Terrorism Implementation Task Force (CTITF), especially on inter-agency coordination in the event of nuclear terrorism[3]. The IAEA serves as the lead organization for the CTITF's Working Group on Preventing and Responding to WMD Terrorist Attacks, which includes the WHO, the UN Office for Disarmament Affairs, INTERPOL, the expert staff of the 1540 Committee and the UN Development Programme (UNDP). The Agency has been responsible for convening high-level meetings and conferences, most notably in March 2010, when it convened a workshop that produced a report on the International Response and Mitigation of a Terrorist Attack Using Nuclear and Radiological Weapons or Materials (CTITF, 2012).

The 1540 Committee has acquired its own expert advisers on physical protection measures, but has also enlisted the help of the IAEA in recommending better protection of nuclear facilities and materials from theft and sabotage (Bunn, 2007). Technical assistance on such matters is already available directly from the IAEA for member states that request it. The Agency has also been involved in assisting states with national implementation legislation to help fulfill their 1540 obligations, but again, the Agency had been doing this irrespective of Security Council involvement.[4] It is therefore not clear whether the 1540 process makes much difference to the Agency's role in nuclear security. It certainly does not provide any additional resources, but given the resolution's legally binding nature, it presumably adds urgency and legal heft to what would otherwise be purely voluntary and, presumably, even tardier action by member states in this area.

Veteran non-proliferation and arms control negotiator, George Bunn, has suggested that given that the 1540 Committee cannot be expected to inspect states to ensure they are implementing the Security Council's recommendations, the Council "would be well advised to consider giving the IAEA a greater role in ensuring that the physical protection requirements of Resolution 1540 are satisfied" (Bunn, 2007). It seems worthwhile, he says, to consider whether IAEA safeguards inspectors could be trained and tasked with checking the adequacy of physical protection at the reactors and other nuclear facilities when they conduct routine inspections. The IAEA inspectors, Bunn suggests, could notify the facilities of any problems, and provide the 1540 Committee with copies of their reports (Bunn, 2007).

The 20/20 Commission also opined that it was "imperative and urgent that the IAEA establish a regular process by which safeguards inspectors would report to the IAEA Office of Nuclear Security any nuclear security weaknesses they observe, with appropriate confidentiality" (IAEA, 2008h: 23). (The Agency is already obliged to do so for projects for which it is providing assistance). The Commission argued that preventing the use of nuclear materials by terrorists should be seen as part of preventing the use for "any military purpose," which is the statutory purpose of safeguards. It advocated training for safeguards inspectors for this purpose. There is likely to be considerable resistance to this among member states and the industry as being too intrusive. The inspectorate is also likely to be reluctant, since it would involve significantly greater responsibilities and training for such tasks and, moreover, may interfere with their primary safeguards mission. Nonetheless, a study should be conducted to examine the implications of such a proposal.

IAEA NUCLEAR SECURITY STANDARDS AND RECOMMENDATIONS

Since 1972, the IAEA has issued non-binding, but authoritative, recommendations on the physical protection of nuclear material

3 The CTITF was established by the UN Secretary-General in 2005 and endorsed by the UN General Assembly through the UN Global Counter-Terrorism Strategy, which was adopted by consensus in 2006. The mandate of the CTITF is to enhance coordination and coherence of counterterrorism efforts of the UN system. The Task Force consists of 31 international entities, which by virtue of their work have a stake in multilateral counter-terrorism efforts. Each entity makes contributions consistent with its own mandate.

4 In 2010, the Agency published the first *Handbook on International Law: Implementing Legislation*, including model texts of legislative provisions covering the key elements needed in a national nuclear law, and *The International Legal Framework for Nuclear Security*, which serves as a guide to the legislative history of the instruments and scope of implementation, including the relevant obligations undertaken by states and the specific functions assigned to the Agency.

and nuclear facilities. These are updated periodically. They reflect, according to the IAEA *Handbook on Nuclear Law,* international consensus on procedures and definitions "going beyond" those in the CPPNM and its Annex 1 (IAEA, 2003c: 146). They describe, among other things (IAEA, 1998), the elements of a state system for the physical protection of nuclear materials and nuclear facilities, and the requirements for physical protection against the unauthorized removal or sabotage of nuclear material in use, storage or transport. Matthew Bunn notes that despite being purely advisory, most states follow the standards and they have "contributed to substantial improvement in nuclear security around the world since they were promulgated" (Bunn, 2010: 53). The United States and several other supplier states require recipient states to apply the standards as a condition of supply. Like the Agency's nuclear safety standards, Bunn notes, however, that the security standards are "quite vague" and can lead to a situation where "it is quite possible for a [nuclear] site to comply with the IAEA recommendations and still have nuclear security arrangements in place that are inadequate to protect against the evolving threat" (Bunn, 2010: 53 and 55).

IAEA NUCLEAR SECURITY SERIES

Fundamentals: the objectives, concepts and principles of nuclear security, providing the basis for security recommendations.

Recommendations: best practices that should be adopted by member states in applying the Fundamentals.

Implementing Guides: further technical elaboration of the Recommendations.

Technical Guidance publications comprise:

- **Reference Manuals**, with detailed measures and/or guidance on how to apply the Implementing Guides in specific fields or activities;
- **Training Guides**, covering the syllabus and/or manuals for IAEA nuclear security training courses; and
- **Service Guides**, which provide guidance on the conduct and scope of IAEA nuclear security advisory missions.

In 2006, the Agency launched its Nuclear Security Series (NSS) to more coherently group and present its nuclear security publications. They are structured in the same way as the IAEA's more venerable documents on nuclear safety, with a similar three-level schema, presumably in an effort to encourage states to treat them the same way. The pace of producing such publications has been ramped up since 2006, with 16 now available.

The most important IAEA nuclear security document is Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225), first published in 1972. Now in its fifth revision, it was released in 2011 after endorsement by the BoG and GC in late 2010 (IAEA, 2011t). The idea of revising the recommendations arose in September 2001, after the terrorist attacks on the United States, when the BoG and the GC endorsed new "Physical Protection Objectives and Fundamental Principles." According to the Agency, by 2005 awareness started to grow of the need to revise INFCIRC/225 to take into account "recent developments and new international legal instruments," which presumably included the CPNNM Amendment (IAEA, 2011t: vi). It took another five years to begin work on a new version. In 2010, an "extensive consultation process" was launched with all member states, including open-ended technical meetings in Vienna, resulting in "an extremely lengthy process" (Price, 2011: 16) to achieve consensus, complicated by the rapidly evolving nuclear security field.

According to Christopher Price of the UK Office for Civil Nuclear Security, Health and Safety, the new version is "by far and away the most comprehensive revision ever undertaken," the result being a much improved set of recommendations that are comprehensive, "hopefully more understandable" and which should serve for the next 10 years (Price, 2011: 16). Although parts remain prescriptive, there has been "considerable movement" towards a performance-based approach. This emphasizes testing and evaluation of effectiveness, together with the establishment, maintenance and exercising of a variety of contingency plans. The new version, according to Matthew Bunn, is certainly more extensive than its predecessor and tightens some of the recommendations.[5] For instance, it recommends that a Design Basis Threat (DBT) be prepared, that performance testing should be carried out and that force-on-force exercises should be conducted (which most countries currently do not do). Price argues that the new document will facilitate decisions by states to accede to the CPPNM Amendment, by providing clarity about their obligations under the amendment.

In a number of respects, according to Bunn, the document continues to fail to get to the heart of the matter: for instance, it is not necessary for all sites with Category I nuclear material — the type and quantity requiring the highest level of nuclear security — to have any armed guards, although if they do not it is recommended that they take other measures to compensate (Bunn, Harrell and Malin, 2012: 16). Of course, the new INFCIRC/225 is still only recommendatory. Bunn argues for a global baseline DBT, which all states should, at a minimum, be obliged to meet. Others argue against this on the grounds that states would then simply treat this as all that they needed to do. Currently, states are only committed to implement Fundamental Security Principles when "reasonable and practical" (Price, 2011: 16).

5 I am indebted to Matthew Bunn, director of the Managing the Atom Project at the Belfer Center, Harvard Kennedy School, for these assessments. Personal communication with the author on December 5, 2011.

The Process of Preparing Nuclear Security Documents

The IAEA's security documents are prepared in close consultation with member states, which is one reason why they achieve such widespread support. For Nuclear Security Fundamentals, Recommendations and Implementing Guides, open-ended technical meetings are held by the Secretariat to allow member states and other international organizations to review drafts. In addition, to ensure a high level of international review and consensus, the Secretariat submits the drafts for formal review to all member states for 120 days. Technical meetings are not required for Technical Guidance papers, but they may be conducted when considered necessary in order to elicit a broad range of views. The drafting and review process takes confidentiality into account, and "recognizes that nuclear security is inseparably linked with general and specific national security concerns" (IAEA, 2008e). Combined with the requirement to translate all documents into all UN languages, the whole process clearly takes a great deal of time.

Since 2002, there has been an Advisory Group on Nuclear Security (AdSec) that meets twice yearly to offer advice to the DG on a wide range of nuclear security issues. AdSec and the CSS established, in 2011, a Joint Task Force to consider the emerging issue, reinforced by Fukushima, of the overlap between nuclear safety and nuclear security. There have, reportedly, been significant disagreements between the two bodies. In May 2011, it proposed that the DG establish a Nuclear Security Guidance Committee of member states to enhance states' involvement with the Secretariat in producing NSS documents (IAEA, 2011u: 7). This was accomplished in 2012, before the Seoul Nuclear Security Summit. A long-term objective of the Task Force is to investigate establishing a single series of Agency standards covering both safety and security, "while respecting the specific character of each." This is a welcome acknowledgement by the Agency of growing support for the importance of the safety/security nexus. In addition, the Office of Nuclear Security has carried out a "gap analysis" and review of document publication priorities to enable better planning of future document production (IAEA 2011u: 6). Whether these reforms lead to faster (or slower) production of safety and security standards by the IAEA remains to be seen, especially if member states become more active in the process.

In the meantime, the Agency has expressed concerns about the risk of duplication and confusion that may arise from the involvement of other bodies in the nuclear security realm, in particular, with regard to nuclear security guidance documents "where competing, or contradictory guidance would likely result in confusion and have a negative effect in the assistance being provided to States…" (IAEA, 2011u: 4). Although the Agency has cooperated with WINS in some of its initiatives, the Agency is obviously worried that this "upstart" might impinge on its role. WINS argues that it is able to produce guidance quickly and effectively by consulting directly with the nuclear industry and security sector, whereas the Agency is required to consult its member states and takes years to revise its existing documentation.

The Agency has admitted that revising the NSS would be a "major undertaking." It has, therefore, taken the route of issuing additional guidance on the security aspects of radioactive sources (IAEA, 2011x). But, as the Agency says rather pointedly in its "Nuclear Security Report 2011," "The international community would best be served by relying on and using the guidance documents developed and adopted by the Agency which, with its mandate, technical competence and broad membership, is uniquely placed to provide States with state of the art guidance" (IAEA, 2011u: para. 16). As the most authoritative and legitimate promulgator of nuclear security standards, the IAEA should engage in a continuous review of the documents and devise a speedier electronic publication process.

The Agency clearly does not have the resources or expertise to meet, in a timely fashion, the demands of this growing field. Its Office of Nuclear Security is staffed with those experienced in dealing with states and regulators, not industry or the security community. Its documentation and other activities are, therefore, geared to member states and official bodies like regulatory organizations. Most nuclear power utilities and security organizations are unlikely to have even heard of the IAEA's role in nuclear security, and may know of it only in the context of safeguards. WINS, on the other hand, comes at the problem from the angle of nuclear plant operators, the police, security firms and security managers. Its training courses, best practice guides and other activities are geared towards them. It would seem that their activities are entirely compatible with the Agency's and, in fact, the two bodies should work closely in cooperation (they already meet formally several times a year). For its part, the Office of Nuclear Security should be authorized to recruit more staff with direct nuclear security experience and enhance its interaction with industry.

Three-year Plan of Activities to Protect Against Nuclear Terrorism

The IAEA offers an impressive array of assistance to states in the nuclear security arena, much of which is now grouped under its three-year plans. This includes conferences, training and advice, but also the provision of equipment, physical protection upgrades, installation of remote monitoring systems and physically securing radioactive sources.[6] The Agency will also dispatch Nuclear Security Teams to provide on-the-spot advice to states. During 2002–2011 such teams visited 95 relevant sites, nearly 200 with radioactive materials and 120 border crossings (IAEA, 2012b: 15). While developing states have, laudably, taken advantage of these, the Agency reports a low participation rate by developed countries which are concerned about issues of confidentiality, illustrating again the secretiveness that surrounds the issue of nuclear security. The Agency also provides

6 For the latest details on all of these, see the Agency's "Nuclear Security Report" (IAEA, 2011u).

assistance and advice in preventing radiological incidents at international sporting events, including the Olympic Games.

The three-year plans are designed to improve the security of nuclear and radioactive material worldwide by assisting states in implementing effective national security measures. The priorities are to provide advice concerning the implementation of international agreements and guidelines, review and assess the needs of member states, provide them with support in implementing nuclear security recommendations, and facilitate outreach and information exchange. Projects include capacity building, security reviews and the development of models for national implementation legislation, as now required under UN Security Council Resolution 1540 (Rauf and Lodding, 2007).

The current 2010–2013 plan, adopted in 2009 (IAEA, 2009e), is third in the series and is currently more than half-way through. According to the Agency, the three-year plans had, by 2008, achieved "sufficient maturity to evaluate its own accomplishments and shortcomings, set meaningful priorities and indicators of success, and take into consideration the evaluations and inputs of other interested stakeholders and groups, including donors to the Nuclear Security Fund" (IAEA, 2008c: 1).

Nuclear Security Funding, Resources and Staffing

The regular budget for nuclear security in the 2012-2013 period was increased to €4.6 million (IAEA, 2011u: 13), but remains small compared the total budget for the Department of Nuclear Safety and Security of close to €34 million. The staff of the Office for Nuclear Security remains proportionately small compared to the whole department (precise numbers are not publicly available). It is currently unable to carry out all the functions demanded of it.

A major challenge for the IAEA's nuclear security work has been its reliance on voluntary funding. As noted, the developing states have argued that since nuclear security is not an original statutory function of the Agency it should not compete for regular budgetary funding. This is disingenuous, since BoG decisions have long endorsed nuclear security as being an important new area of concern for the IAEA. Paradoxically, the West uses the same argument against bringing Technical Cooperation (TC) into the regular budget. There would appear to be a budgetary compromise to be negotiated here (see Part Nine: Finance and Budget for further analysis of this possibility). Along with such a budgetary deal could eventually come the establishment of a separate Department for Nuclear Security, which would give nuclear security its own bureaucratic voice and mark it as a distinct Agency function. Care would have to be taken not to disrupt current efforts to ensure that nuclear safety and nuclear security are treated as complementary and synergistic.

Nuclear security is currently 80 percent funded from extra-budgetary resources (IAEA, 2011d: 6) through the Nuclear Security Fund (NSF). From its establishment in 2002 until the end of 2011, the NSF will have dispersed around $130 million in various nuclear security projects (IAEA, 2011u: 13). Funding for the three-year plans comes from donations from just a few states, mostly Western, but also including Japan and South Korea. Member states also provide "in kind" contributions, such as equipment, cost-free experts, the use of facilities, and the hosting of meetings and training activities. A major new source of funding is the EU Strategy against Proliferation of Weapons of Mass Destruction.

A stumbling block to a more effective and efficient program is that 90 percent of the funds donated come with conditions. These are primarily limitations on the geographic location of the project for which funds can be used, and/or the purposes to which they may be applied, as well as restrictions relating to procurements and human resources. The Agency notes, delicately, that such restrictions make "setting overall programmatic priorities difficult" (IAEA, 2008f: 2).

IAEA ADVISORY SERVICES AND MISSIONS

As in other areas of the Agency's work, a significant part of its work involves assisting states with advice and support. The following are the major activities in the nuclear security field.

Nuclear Security Evaluation Missions

The International Physical Protection Advisory Service (IPPAS) conducts, at the request of a member-level state, a detailed review of the state's legal and regulatory infrastructure that will determine the extent of compliance with the CPPNM. It also seeks to compare national practice with IAEA standards and international best practice. A confidential mission report by each IPPAS mission is intended to form the basis of remedial action. The IAEA provides subsequent assistance such as training, technical support and more targeted assessments. Between 2002 and 2011, 41 IPPAS missions were conducted (IAEA, 2012b: 15). At the request of their respective governments, the Agency carried out — in the second half of 2011 — unprecedented IPPAS missions in three states with large nuclear programs: France, the Netherlands and the United Kingdom. The Agency hopes these will "point the way to such missions becoming widely used as an important tool to build confidence both within the international community and the general public with regard to the effectiveness of national nuclear security systems" (IAEA, 2011u: 8). Norway, the first developed country to invite such a mission, has encouraged all other states to do so, as a way of benefiting from international advice (Norway, 2004).

The Agency's International Nuclear Security Advisory Service (INSServ) conducts missions, at a state's request, to assist in identifying its broader nuclear security requirements, and the ways in which it can fulfill them. A report is generated, which can serve as the basis for cooperation between the state and the IAEA, and for bilateral nuclear security assistance. Between 2002 and 2011, 39 INSServ missions were conducted (IAEA, 2012b: 15).

In addition to these missions, International Teams of Experts (ITE) are convened as a "primary mechanism for promoting and facilitating states' adherence to the legal instruments designed to prevent nuclear terrorism." The Agency carried out 28 ITE missions between 2002 and 2011 (IAEA, 2012b: 15).

As noted in the nuclear safety section of this report, the Integrated Regulatory Review Service was inaugurated in 2006 to help states, at their request, to improve the effectiveness of national regulatory bodies and to assist in the implementation of national safety legislation and regulations. These reviews may benefit states' nuclear security infrastructure by fostering more effective national regulators and better legislative frameworks. The Office of Nuclear Security has conducted nine of these since 2002 (IAEA, 2012b: 15).

Integrated Nuclear Security Support Plans

The Integrated Nuclear Security Support Plan (INSSP), based on findings from nuclear security support missions, attempts to provide states, in contrast to the previous ad hoc approach, with a "holistic" approach to nuclear security capacity building. The plan is individualized to meet the needs of each state. To date, more than 60 INSSPs have been developed and are in various stages of finalization. As of 2011, 31 states had finalized them (IAEA, 2012b: 15). The Agency reports that feedback from states about their INSSPs has been "positive," but they have learned that "the availability of resources, both internal and external, is fundamental for achieving the projected results" (IAEA, 2011u: 5).

Nuclear Security Support Centres

In 2008, the IAEA developed a conceptual approach for the establishment and maintenance of national Nuclear Security Support Centres (NSSCs) to foster a "systematic, business-oriented approach" to nuclear security (IAEA, 2008f: 17). The Centres are meant to serve as a focal point for sustainable and continued access to knowledge, skills and abilities. As of 2012, such centres have been established in seven countries (IAEA, 2012b: 15). The Agency has focused on providing states with "train the trainer" courses that will assist them in setting up their NSSCs. The Agency has recently supported Columbia in establishing an NSSC, which will help train officers from member states of the AMERIPOL, which is headquartered in Bogota (IAEA, 2011u: 12).

Nuclear Security Education and Training

From 2002 to 2011, IAEA nuclear security training reached over 10,200 persons in some 120 states. More than 250 physical protection training events were conducted and more than 6,400 people from 120 member states were trained in the areas of prevention (IAEA, 2012b: 12 and 21).

In 2010, the IAEA created the International Nuclear Security Education Network (INSEN) to provide a forum for the Agency, educational institutions and research bodies to collaborate in establishing nuclear security education (IAEA, 2012b: 13). INSEN members cooperate in developing instructional texts and computer tools, conducting joint research projects and in arranging student and faculty exchange programs. Also in 2010, the IAEA completed its largest project to date in its physical protection activities — the completion of the nuclear security training facility at the Interdepartmental Special Training Centre in Obninsk, Russia. The first international training course took place there in October 2010. The IAEA is also working with 50 academic institutions to implement Master of Science-level courses in nuclear security through the production of textbooks and lecture notes, and the professional development of lecturers (IAEA, 2012b: 15)

IAEA ACTIVITIES IN COUNTERING NUCLEAR SMUGGLING

The discovery in 2002-2003 of a global illicit nuclear smuggling network, operated by Pakistani nuclear program director Abdul Qadeer (A.Q.) Khan, gave the IAEA the impetus and licence to probe such activities — both in an attempt to unravel the A.Q. Khan case and to detect new ones. After working at the URENCO enrichment plant in the Netherlands for several years, Khan had used the training he received and the blueprints he stole to spearhead an enrichment program in Pakistan, ultimately leading to its acquisition of nuclear weapons. Even more important than the expertise he obtained were the contacts he made. Subsequently, Khan set up an international smuggling network to provide Iran, Libya and North Korea with various degrees of illicit nuclear assistance, including blueprints for Iran's enrichment program.[7] The Libyan case, in particular, has revealed a widespread international nuclear procurement network that traditional nuclear safeguards and other verification tools were unable to detect. IAEA activities in countering nuclear smuggling are intended to further both nuclear security and non-proliferation objectives.

Nuclear Trade and Technology Analysis Unit

The IAEA established an "elite investigative" group in the Department of Safeguards in 2004, tasked with centralizing all information available to the Agency, in order to track known smuggling networks and endeavour to detect new ones — the Nuclear Trade and Technology Analysis (TTA) Unit. Notably, the unit monitors, with the help of some states and companies, refusals of suspicious import enquiries and orders, with the aim of detecting patterns and linkages. It also maintains the IAEA's institutional memory on covert nuclear-related procurement activities. Safeguards strengthening measures, such as those in the AP and Voluntary Reporting Scheme, already provide the Agency with some information related to procurement and supply, and this information is part of the Agency's state evaluation

7 For a more detailed account of Khan's history, see Hibbs (2008: 381–391).

process.[8] However, the information provided through these measures is mainly related to actual exports, not information on procurement activities or export denials (IAEA, 2006i).

The TTA needs greater cooperation from IAEA member states and companies, and greater financial and personnel support (it only has a few expert analysts) if it is to realize its full potential. As in the case of the related Illicit Nuclear Trafficking Database (see the Nuclear Security section), the TTA Unit is probably receiving information concerning only a fraction of the cases that are actually occurring. In 2006, the Agency launched an outreach program to states seeking nuclear trade-related information from them on a bilateral, voluntary basis. Although by the end of 2007 some 20 states had been contacted, only a few are providing information (Tarvainen, 2009: 63). Charles Ferguson argues that intelligence agencies, while protecting sources and methods, could and should share more information with the IAEA. He points out that "the CIA penetrated Khan's black market but kept the IAEA in the dark about this activity for years" (Ferguson, 2008). David Albright, in his testimony before the US House of Representatives Subcommittee on Terrorism, Nonproliferation, and Trade also contends that the work of the TTA Unit is not integrated into the IAEA's normal safeguards operation. Doing so would, he claims, "dramatically increase the chances of detecting and thwarting illicit nuclear trade, while improving the ability of the IAEA to detect undeclared nuclear facilities and materials."[9]

In addition to the TTA, the Agency's Safeguards Information Management directorate has two small units that have quasi-intelligence functions, one that analyzes open-source information and another that assesses imagery. The former head of the directorate has called for a more professional, targeted IAEA "intelligence" capability, but many member states would be wary of such a venture.[10]

IAEA Illicit Trafficking Database

Established in 1995, the IAEA's Illicit Trafficking Database (ITDB) is designed to facilitate the exchange among states of authoritative information on reported incidents of illicit trafficking in all types of nuclear materials and radioactive sources. The ITDB covers unauthorized acquisition (for example, theft), supply, possession, use, transfer or disposal of nuclear and other radioactive materials, whether intentionally or unintentionally, with or without crossing international borders. The ITDB also covers unsuccessful or thwarted acts, accidental loss of materials and the discovery of uncontrolled materials. All types of nuclear materials (uranium, plutonium and thorium), all naturally occurring and artificially produced radioisotopes, and radioactively contaminated materials are covered. No limit is placed on the quantity of material recorded in the database, its activity level or other technical characteristics. States are also encouraged to report scams in which non-radioactive materials are offered for sale as nuclear or radioactive materials. The ITDB information is analyzed continuously by the Agency's staff, to identify trends and patterns, assess threats and evaluate weaknesses in material security and detection capabilities and practices (IAEA, 2006d). The Secretariat produces Quarterly and Annual Reports containing ITDB statistics and analysis. Participating states are also provided with regularly updated CD-ROM versions of the database.

In the early years of the ITDB, most initial information came from press reports rather than states. Currently, however, the ITDB collects information from 112 member states (IAEA, 2011u: 4) and one from "non-member state." The ITDB still collects information from open sources, but seeks confirmation about its veracity from the member state concerned. Communication with participating states is maintained through a network of national Points of Contact (POC). Meetings of the POCs are organized regularly to review the operation of the ITDB. One of the difficulties with this reporting instrument, as with others in the nuclear safety and security area, is that not all states provide reports and not all provide the requisite information when they do report. States are not obliged to contribute, since the database does not derive from a treaty obligation or other international agreement.

Since July 2007, the IAEA has convened regional information meetings designed to: help strengthen national, regional and international capacities through enhanced information- and knowledge-sharing, management and coordination; improve awareness about the ITDB program and enhance reporting of incidents; foster regional dialogue; and promote a culture of networking. More than 120 states have taken part in such meetings.

Assistance to States in Combating Nuclear Smuggling

The IAEA continues to assist states to establish effective border monitoring capabilities. In 2010, it worked with 15 states, providing over 280 items of equipment to improve detection and response capabilities (IAEA, 2011u: 11). The Agency established the Border Monitoring Working Group in 2006, to promote and coordinate multilateral and bilateral cooperation in establishing detection monitoring capabilities at borders, mostly with the United States and the European Union, but more recently with Canada and the Francophone African states. In addition, the IAEA's Nuclear Security Equipment Laboratory helps ensure that border detection instruments meet technical and functional specifications. DG Amano told the Nuclear Security Summit in Seoul in 2012 that IAEA training of Moldovan officials and the provision of equipment had helped them prevent an attempt at smuggling of HEU in 2011 (Amano, 2012).

8 Annexes I and II of the AP identify activities involving the manufacture and/or construction of certain nuclear fuel cycle related items and material, and items required to be declared to the Agency when exported. The AP provides for a simplified mechanism for amending the Annexes by the BoG on the advice of an open-ended working group of experts established by the Board. This has not happened since the approval of the Model AP in 1997 (Note by Secretariat 2006/Note 2: 5)

9 See: www.globalsecurity.org/wmd/library/congress/2007_h/070627-albright.htm.

10 Elaine M. Grossman (2009). "Boost in IAEA Intelligence Capability Looks Unlikely in Near Term." *Global Security Newswire.* June 22.

Improving Use of IT for Nuclear Security Program

In view of the increasing volume of information it is receiving, the Agency is taking several steps to enhance its IT capability in the nuclear security area. First, it is investigating the suitability of advanced software tools to enhance the Secretariat's own analytical capacities (IAEA, 2011u: 5). Second, in late 2010, the Agency enabled access to the Nuclear Security Information Portal for all its member states and selected international organizations (IAEA, 2011u: 5). It is intended to provide an "interactive knowledge-based environment" to enhance nuclear security cooperation, facilitate joint activities and share information. As of June 30, 2011, it had over 300 registered users from nearly 70 member states and six international institutions. Finally, the Electronic Programme Support System, which had been used to manage the activities and funding of the nuclear security program was retired at the end of 2010 and replaced by the Agency-wide Information System for Programme Support (AIPS) (IAEA, 2011u: 13).

OTHER ACTIVITIES

Despite opposition from the NAM, led by South Africa, to the IAEA making "HEU minimization" a significant goal, the Agency has been quietly cooperating with the United States, Russia and other member states in securing and repatriating nuclear materials from around the world, notably high (or highly) enriched uranium (HEU) from research reactors in vulnerable locations. It has also helped convert research reactors from HEU to LEU in six states and produced and made available high capacity dual purpose spent fuel casks for the movement of HEU research reactor fuel (IAEA, 2012b: 17). These efforts contribute to the US Cooperative Threat Reduction programs and/or the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction. In November 2010, the Agency was involved in the largest repatriation project in its history, involving nearly 400 Serbian and international experts, including 76 Agency staff, when it facilitated the shipment of HEU and low enriched uranium (LEU) from Serbia's Vinča research reactor to the Mayhak Fissile Material Storage Facility in Russia (IAEA, 2011u: 10). In addition, Russia, the United States and the IAEA have established a Tripartite Initiative on the Securing and Managing of Radioactive Sources to facilitate the identification and securing of high activity, vulnerable radioactive sources (IAEA, 2012b: 19). Finally, the Agency is working to accelerate the development of forensics support for nuclear security purposes through the production of guidance documents, establishment of a collaborative network and the development of Coordinated Research Projects (IAEA, 2011u: 14).

CONCLUSIONS

The IAEA has clearly made enormous strides in the area of nuclear security in recent years. It has increased the number and quality of nuclear security guides and recommendations, and its assistance to states has expanded, notably through its Three-year Plans. Continuing and increasing contributions to the NSF in support of such work indicate the success it is having. However, the Agency is also searching for its proper niche in the nuclear security area among the welter of initiatives that have arisen in recent years, most notably the high-profile nuclear security summits. The Office of Nuclear Security requires additional resources and personnel if it is to emerge with a central role in the multilateral sphere. As the "Nuclear Security Report 2011" notes, "in advance of the review that will take place in 2012, it is already clear that the Agency does not have the resources to meet all requests for assistance" (IAEA, 2011u: 14). Moreover, the Agency also confronts the reality that the nuclear security regime, while much improved over the past 10 years, "is still a patchwork of voluntary, nonbinding, non-transparent national commitments, ad hoc bilateral and multilateral initiatives, and vague legally binding measures that provide no specific standards that states must follow" (Fissile Materials Working Group [FMWG], 2012: para. 7).

The Seoul Nuclear Security Summit in March 2012, noted "the essential role of the IAEA in facilitating international cooperation and supporting the efforts of States to fulfill their nuclear security responsibilities" (NSS, 2012) and "reaffirmed the essential responsibility and central role of the IAEA in strengthening the international nuclear security framework." Participating states recognized the value of the IAEA Nuclear Security Plan 2010–2013 and pledged that they would work to ensure that the IAEA "continues to have the appropriate structure, resources and expertise needed to support the implementation of nuclear security objectives." While falling short of endorsing "HEU minimization" as a goal, the summit "recognized" the "development, within the framework of the IAEA, of options for national policies on HEU management." It also welcomed efforts of the IAEA to organize meetings to provide "recommendations on the interface between nuclear security and nuclear safety so that neither security nor safety is compromised." Perhaps most importantly, it welcomed DG Amano's proposal to organize an international conference in 2013 on nuclear security cooperation, an initiative that my eventually grow into a more permanent successor to the nuclear summit process.

With nuclear security still in its infancy as a multilateral concern, compared to nuclear safeguards and nuclear safety, fundamental questions remain to be fully aired. Among these are proposals for a comprehensive or umbrella nuclear security convention, presumably to be negotiated under IAEA auspices. A second issue is that of making nuclear security standards mandatory and charging the IAEA with monitoring states parties' compliance. The 20/20 Commission recommended that states negotiate binding agreements that "set effective global nuclear security standards and give the IAEA a precise mandate to confirm that these standards are being implemented"

(IAEA, 2008h: 22). The non-governmental FMWG, among its recommendations for the Seoul Summit, proposed an international framework convention on nuclear security, by 2020 or sooner, that "builds on, and expands, existing principles and establishes binding baseline standards of performance for nuclear security" (FMWG, 2012: para. 7). The Convention should, it suggested: reduce overlap in the current regime while filling important policy gaps; allow for important, if limited, sharing of information in order to increase international confidence in every nation's security practices; reinforce the IAEA's mandate to provide impartial reviews and technical assistance to states to help them meet these performance standards; and make the IAEA the Convention's executive agent to monitor and evaluate implementation of these standards and requirements. Specific future requirements should be codified in subsidiary protocols.

The proposal for a comprehensive convention is logical and laudable. However, given that states have still not managed to bring the CPNNM Amendment into force after six years, and given their reluctance to endorse legally binding safety peer reviews after Fukushima, it is unlikely that they would be inclined to negotiate a new nuclear security treaty with legally binding standards and peer review, and/or IAEA monitoring. Add to this the legal complexities of yet one more convention, and it would appear that it is preferable at this stage to move incrementally in the nuclear security area until there is more support for a comprehensive overhaul. There is much to be done in strengthening the IAEA's role, short of negotiating new legal instruments. It is to be hoped that it does not take a nuclear terrorism incident to engender the necessary resolve to go further faster.

RECOMMENDATIONS

- The IAEA should engage in a continuous review of its nuclear security documents and devise a speedier electronic publication process.
- The Agency should collaborate closely with WINS to ensure that their respective strengths are brought to bear in terms of training, guides and assistance to all nuclear security stakeholders.
- Supportive member states should increasingly avail themselves of the IPPAS peer review and other IAEA security services, in order to make these commonplace and to encourage all states to take advantage of them; expanded funding should be provided by member states to meet the demand.
- The Agency should investigate the idea, suggested by the 20/20 Commission, of training and making standing arrangements for nuclear safeguards inspectors to report any nuclear security weaknesses they observe.
- States seeking technical assistance should be encouraged by the Agency and donor states to request projects that will assist them in enhancing their national nuclear security.
- Member states should provide more regular budget funding for the Office of Nuclear Security.
- A budgetary deal should be sought to bring nuclear security properly into the regular budget and, eventually, to create a separate Department of Nuclear Security.
- In the meantime, the Office should strengthen its ability to assess nuclear security and nuclear terrorism threats, and interact more closely with plant owners and operators, police and intelligence agencies; to do this it should recruit more personnel with nuclear security experience; member states should provide additional funding for this purpose.
- Member states should provide more resources and more skilled analysts for the Agency's illicit nuclear trafficking monitoring and analysis efforts.
- The Agency should continue to explore the possibilities of cutting-edge IT systems for creating a true international nuclear security network among its member states and relevant international organizations.

IAEA safeguard inspector checking fuel assembly in a transport container located in the fresh fuel storage of the Mochovce nuclear power plant. (IAEA Photo by Dean Calma)

PART FIVE: NUCLEAR SAFEGUARDS AND VERIFICATION

The IAEA's nuclear safeguards and verification system[1] is a major achievement of international governance, imposing a degree of intrusiveness on states that is unknown in almost any other field. It has also been a constant work in progress, sometimes at a slow pace, sometimes arguably even regressing, but at other times responding rapidly, and creatively, to crisis. The process may be likened to the "punctuated equilibrium" of evolution itself, whereby long periods of relative stasis are interrupted by dramatic events that change its course (Findlay, 2007). Safeguards (and the IAEA itself) are, of course, only one part of a much larger non-proliferation regime that includes multinational, bilateral and unilateral measures, which collectively reinforce the barriers that safeguards can erect.

The original meaning of the term "safeguards" was broad. It was used by American analysts, policy makers and politicians in the 1940s and early 1950s to mean all of the verification measures needed to ensure nuclear disarmament once the United States gave up its small arsenal. Subsequently, with the establishment of the IAEA, the term narrowed to mean the nuclear accounting, inspection and other measures needed to detect the non-diversion of nuclear material from declared, peaceful purposes to undeclared purposes, including for weapons. Since the discovery of Iraq's undeclared activities after the 1990 Gulf War, the term has once again widened to encompass a growing number of verification activities, including those directed at discovering undeclared materials and facilities, illicit nuclear transfers, smuggling activities and weaponization activities. The objectives of safeguards are to:

- provide timely warning of diversion of material and facilities from peaceful uses to nuclear weapon purposes;

1 While the IAEA, member states and those who study the Agency also use the term "verification," especially with regard to the activities and techniques used to resolve allegations of non-compliance, they also have a tendency to use safeguards to encompass all of the Agency's verification activities. This report will largely follow that practice.

- deter potential non-compliers through the possibility of being detected and by raising the costs of hiding undeclared activities; and
- help all parties, even the most well-intentioned, demonstrate to each other that the non-proliferation undertakings they have made are being adhered to.

As Bürchler has noted, the history of safeguards is characterized by "the struggle between its advocates and its detractors" (1997: 48). Outright opponents of safeguards, or those who at various times have sought to limit their scope and nature, have been concerned about their: impingement on state sovereignty; intrusiveness in terms of both state security and commercial confidentiality; cost; and relative prominence within the Agency's overall mandate. The ebb and flow of support for safeguards and especially their strengthening over time, may be attributed to both crises of confidence in the system — most dramatically in the case of revelations about Iraqi violations exposed by the Gulf War — and changing perceptions about the ease with which proliferation can occur (notably to terrorists and less advanced states); and to the changing fortunes and policies of various governments.

The Western states, led by Australia, Canada, the Scandinavian countries, Japan, the United Kingdom, the United States and original members of the European Union, notably the Netherlands and Germany, have increasingly promoted the strengthening of nuclear safeguards (although some not always as enthusiastically as might be expected). While some of these states were originally skeptical of safeguards (after all, this was a new departure in international affairs), over time, they have become convinced of their efficacy and necessity.

As verification has intensified over the years at the behest of Western states, developing countries have, invariably, argued that this threatens to unbalance the IAEA's priorities, leaving cooperation for peaceful uses disadvantaged. Sensing that verification cannot be rolled back, and aware that they too derive security benefits from the system, developing states have adopted the tactic of linking increases in the verification budget to increases in the technical cooperation program. The more radical non-aligned countries such as Cuba, Egypt, India, Iran, Pakistan, Syria and Venezuela, have attempted to attenuate or delay improvements to the system, some of them no doubt due to their nuclear weapon ambitions.

The original safeguards document was contained in the Agency's innocuous sounding Information Circular Number 26 (INFCIRC/26) of March 30, 1961 (IAEA, 1961).[2] Reflecting the Agency's careful, incremental approach, INFCIRC/26 safeguards only applied to small reactors of less than 100 MW (thermal) and material transferred from one state to another, but they were later extended to large reactors (IAEA, 1964). INFCIRC/26 agreements only ever numbered six.[3] Most of these agreements resulted from the transfer of existing bilateral arrangements, mostly American, to the Agency. In addition, the Americans also transferred safeguards knowledge, experience and technologies to the Agency, thereby shaping the international system in their own image.

Having originally opposed or expressed great skepticism about safeguards, the Soviets soon realized that they would be invaluable in helping prevent nuclear weapons proliferation that might threaten their own security. In 1963, they dramatically announced that they would support strengthened safeguards.[4] Drafted by the Secretariat and approved by the BoG in 1965 as document INFCIRC/66,[5] the new model applied safeguards to all nuclear materials and facilities in which such materials were used, processed, stored or contained (IAEA, 1968). These included research and power reactors, spent fuel reprocessing plants, fuel fabrication and conversion facilities and storage sites, but not uranium or thorium mines or mills. INFCIRC/66 safeguards were more elaborate and intrusive than previous safeguards, and when amended by the BoG in 1964, were to last in perpetuity. While most of these agreements were soon superseded by safeguards required under the NPT,[6] some survive, notably those applied to select facilities in the three states still outside the global non-proliferation regime: India, Israel and Pakistan.

COMPREHENSIVE OR FULL-SCOPE SAFEGUARDS

The real revolution in safeguards came with the negotiation and entry into force of the NPT. The Treaty imposed a legal obligation on its non-nuclear weapon states parties to place all of their nuclear activities under IAEA safeguards, since all of them would, by definition, be "peaceful."[7] Hence, the use of the terms "full-scope" or "comprehensive." Safeguards would be applied to "*all* source or special fissionable material in all peaceful nuclear activities…for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices [emphasis added]" (IAEA, 1972a: para. 2).[8] This would encompass HEU, plutonium and uranium-233, all materials that can be used directly in nuclear weapons. It also would include natural, low enriched and depleted uranium and thorium (IAEA, 2007a: 8). Radioactive sources, such as those for x-ray machines and other medical, agricultural and industrial purposes that do not contain fissile material, were not to

2 Amended to INFCIRC/26/Add 1 on April 9, 1964.

3 Canada, Japan, Finland, Norway, the United Kingdom and the United States.

4 Soviet Ambassador Vassily Emelyanov informed a startled BoG that, as the governors knew, the Soviet Union had always regarded safeguards as the most important task of the Agency (Fischer, 1997: 249).

5 Revised in 1966 to include reprocessing plants, it became INFCIRC/66/Rev.1 and in 1968, was extended to cover nuclear material in conversion and fabrications plants, becoming INFCIRC/66/Rev. 2, the most current version of the document.

6 In NPT states parties they are "suspended," but would be reactivated automatically should NPT-based safeguards disappear.

7 There is the anomaly of non-explosive military uses for nuclear-powered submarines, but to date no NNWS has availed itself of this.

8 This is the basis on which the Agency is able to verify not just the correctness, but the completeness, of states' safeguards declarations.

be subject to safeguards and would not need to be reported to the IAEA. Each state party would be obligated to negotiate a bilateral comprehensive safeguards agreement (CSA) with the Agency.

Although no amount of material, no matter how small, should be diverted, safeguards measures seek to provide reasonable assurance of the timely detection of a "significant quantity" (SQ) of declared "special" nuclear material (that suitable for bomb-making) being diverted from peaceful uses to nuclear weapons production and to deter such diversion by the risk of early detection. Verification is accomplished, as in the original safeguards arrangements, through nuclear accountancy, on-site inspection and technical means. But the new system, pursuant to the NPT, also introduced new concepts to improve effectiveness (Scheinman, 1987: 153): focusing safeguards on "strategic points" where verification might be most revealing; using instrumentation and non-human inspection techniques; using surveillance (today, increasingly, continuous real-time remote monitoring using video cameras) and containment as important complements to material accountancy; and having a requirement that states establish a State System of Accountancy and Control (SSAC). INFCIRC/153 also placed tighter limits on the Agency itself, regulating the designation and right of rejection of Agency inspectors by states, and setting out dispute resolution arrangements.

The most extensive new right was that of a Special Inspection, which could be requested when inspectors suspect that undeclared activities or facilities exist. There are, in theory, no limits to the IAEA's access when carrying out such inspections: inspectors would "have access to any place in the State concerned." The IAEA would need permission from the state concerned, but if it refused, the BoG could order the state to permit access and, if it still refused, could report to the UN Security Council that the Agency was "not able to verify that there has been no diversion" (Fischer, 1997: 282-283).

In addition to a Safeguards Agreement, each state was obliged to conclude a Subsidiary Arrangement with the IAEA to tailor safeguards to its own situation, set out the mode, timing and extent of inspection activities, and protect confidentiality. Included are Facility Attachments, which encompass a design information questionnaire. Such arrangements are not imposed by the Agency, but are also negotiated with each state. They are confidential and are not submitted to the BoG for approval or even information.

Although states could use the confidentiality of the negotiation process to unduly pressure the Agency to lower its inspection sights, there is no evidence this has occurred. There has only been one case, Iran, where a state has refused widely adopted changes to such agreements, which may be necessary as a result of technological or other developments.[9] Iran also appears to be the only case of a state unilaterally attempting to suspend part of its Subsidiary Arrangement (IAEA, 2008d: 9, E.2).

The detonation of a nuclear device in May 1974 by India, a non-NPT party, was an unexpected shock for the new safeguards regime, coming only four years after the NPT entered into force. Although India had not violated an IAEA safeguards agreement, but rather a "gentleman's agreement" with Canada and the United States, the test spotlighted the "peaceful nuclear explosion" loophole in INFCIRC/66 safeguards. This was promptly closed by the BoG, which after 1975 made its approval of INFCIRC/66 agreements contingent on an undertaking that no safeguarded items be used "for the manufacture of any nuclear weapon or to further any other military purpose or for the manufacture of any other nuclear explosive device" (Scheinman, 1987: 137–139).[10] The Indian explosion also led to the establishment of the Nuclear Suppliers Group (NSG), originally the London Club, a non-IAEA gathering of nuclear exporting countries that seeks, by consensus, to agree guidelines to restrict export of certain nuclear and dual-use materials, equipment and technologies, including to NPT parties.

Notwithstanding grumblings about the cost and the perceived unfair safeguards burden on states with substantial peaceful nuclear industries such as Canada, Germany and Japan, the legitimacy of the system was, until the early 1990s, increasingly accepted by Agency members, and its efficacy taken for granted. The number of states parties to the NPT increased to near universality. The Secretariat was, by and large, able to report annually to the Board that it had no indication that there had been diversion of nuclear materials or facilities under NPT safeguards from peaceful to military purposes. The two exceptions were non-NPT parties India and Pakistan in 1981 and 1982 respectively, but these were resolved more or less to the Agency's satisfaction (Fischer and Szasz, 1985: 16-17). On several occasions, the Agency was hindered in its inspection activities (Goldblat, 1985: 7). There have been subsequent revelations of relatively minor, but still troubling, violations in the early 1980s by Egypt, Romania, South Korea and Taiwan, but these were not discovered at the time.[11] As Hans Blix also points out, at least one IAEA member state, Israel, signalled its own abiding distrust of IAEA safeguards by bombing Iraq's Osirak research reactor in 1981 (2005: 19), an action that was condemned by the UN Security Council as "a serious threat to the entire safeguards system." Nonetheless, IAEA member states seemed to have had confidence in the safeguard system — although there were credible academic and non-governmental critics throughout this period (Fischer and Szasz, 1985).

THE SAFEGUARDS CRISIS: IRAQ CASE REVEALS SHORTCOMINGS

The general complacency over safeguards was shattered with the revelation following the 1990 Gulf War that Iraq had been

9 Lawrence Scheinman reports that Pakistan only reluctantly accepted changes to safeguards on its Kanupp reactor in the 1970s (Scheinman, 1987: 140).

10 Lawrence Scheinman reports that three BoG members reserved their position on the issue. The United Kingdom and United States had, presciently, been pressing for this since 1972 (1987: 139).

11 For Romania, see Mozley (1998: 167); for Egypt and South Korea, see GAO (2005: 20); for Taiwan, see Quester (1985).

clandestinely mounting a nuclear weapons program in parallel with its IAEA-inspected peaceful program. The failure of the IAEA to detect Iraqi activities located, in some cases, "just over the berm" from where inspectors regularly visited, brought ridicule from those who misunderstood the limitations of its mandate and despair on the part of safeguards experts who had, for years, feared this outcome. As former Australian ambassador to the IAEA, Michael Wilson, lamented: "in the enthusiasm to find an obvious and defenceless scapegoat, the Agency was perceived to be complacent and unobservant. The limitations on safeguards inspections, whose principles had been agreed by governments, were either disregarded or apparently not understood" (Wilson, 1997: 130). As Hans Blix points out, the system was "designed primarily with open, advanced industrial countries in mind" and was "too weak to ensure the discovery of clandestine installations in a closed society" (2005: 18).

The most fundamental problem was that IAEA's focus on materials and facilities formally declared to it by the state. This provided would-be proliferators with the latitude to develop substantial, undeclared nuclear capabilities undetected, either co-located with declared facilities or completely separate. A further difficulty was the reliance on nuclear accountancy as the principal tool for detecting non-compliance with safeguards and, in turn, dependence on safeguards themselves as the key tool in detecting non-compliance with the NPT. Political limitations placed on the design of safeguards had, in the early years, led to a presumption of compliance and a conservative safeguards culture that ultimately proved unable to detect serious non-compliance beyond declared facilities. The Agency felt it could not use all of the powers it had acquired, including "special inspections." It tended to ignore unofficial information or indicators of nuclear proliferation beyond diversion, notably weaponization activities (Acton and Newman, 2006) and nuclear smuggling; in addition, it failed to take a holistic view of states' activities.

Following the revelations of the Iraqi program, the IAEA managed to redeem itself in the eyes of many critics by the professional manner in which it verified the extent of Iraq's non-compliance, and assisted it in destroying its nuclear infrastructure in accordance with UN Security Council demands (2005: 28-29). The Agency achieved this through an Iraq Action Team established especially for the purpose, and in (mostly) close cooperation with the UN Special Commission and the UN Monitoring, Verification and Inspection Commission. These bodies had been established and mandated by the Security Council to verify and assist in Iraq's disarmament in the chemical, biological and missile fields.[12] In this way, the IAEA derived novel experience and expertise in conducting verification in a state that was obliged by the Security Council to cooperate and essentially provide "anytime, anywhere" access. As Hans Blix notes, the early results of the IAEA inspections were "spectacular" (2005: 23). When Iraq failed to fully cooperate the Agency acquired additional invaluable experience in countering Iraq's campaign of denial and deception.

The Agency scored another victory in 1992 by being the first to detect North Korea's non-compliance with its new safeguards agreement. It was able to do so by using safeguards-derived information in calculating that the country's declarations of its plutonium production were improbably low (IAEA, 2003b).[13] The Agency also earned praise for the way in which it verified, beginning in 1993, South Africa's divestiture of its small cache of nuclear weapons. However, the Agency missed non-compliance by Libya, which was not publicly revealed until December 2003, through the efforts of the United Kingdom and the United States, rather than the IAEA. It also missed Iran's 18-year pattern of non-compliance, which was eventually revealed by an Iranian opposition group.

STRENGTHENED SAFEGUARDS

The Agency has now been engaged for almost 20 years in strengthening its safeguards system as a result of the Iraq, and subsequent, cases. Annex 4 provides a list of the main strengthening measures since 1991. The Agency believes that the changes "are of such magnitude that they can rightly be characterized as a revolution, rather than an evolution" (IAEA, 2007a: 15).

12 Hans Blix concludes that, despite some friction between the IAEA and its Security Council-mandated counterparts, at no time did this "translate into reduced effectiveness" (Blix, 2005: 23).

13 Isotopic analysis showed that the plutonium declared did not match the declared history of the relevant facilities.

Table 2: Safeguards-strengthening Measures

A. Measures under comprehensive safeguards agreements

- State provision of design information on new facilities or on changes in existing facilities handling safeguarded nuclear material as soon as the state authorities decide to construct, authorise construction of or modify a facility; and the IAEA's continuing right to verify the design information over the facility's life cycle, including decommissioning.
- Agency enhanced evaluation of information from a state's declarations, Agency verification activities and a wide range of open and other sources (e.g., the scientific literature, news articles, satellite imagery, and third parties).
- State voluntary reporting on inventories, imports and exports of nuclear material and exports of specified equipment and non-nuclear material (components of this scheme are incorporated in the Model Additional Protocol).
- Agency use, to a greater extent than previously, of unannounced inspections within the routine inspection regime.
- Agency collection of environmental samples in facilities and at locations where, under safeguards agreements, IAEA inspectors have access during inspections and design information visits; and sample analysis at the IAEA Clean Laboratory and / or at qualified laboratories in member states.
- Provision of enhanced training for IAEA inspectors and safeguards staff and for member state personnel responsible for safeguards implementation.
- Agency use of unattended and remote monitoring of movements of declared nuclear material in facilities and the transmission of authenticated and encrypted safeguards-relevant data to the Agency.
- Closer co-operation between the Agency and the state (and regional) systems for accounting for and control of nuclear material (SSACs) in member states.

B. Measures under additional protocols

- State provision of information about, and IAEA inspector access to, all parts of a state's nuclear fuel cycle, from uranium mines to nuclear waste and any other location where nuclear material intended for non-nuclear uses is present.
- Agency collection of environmental samples at locations beyond those provided under safeguards agreements.
- State provision of information on, and agency short-notice access to, all buildings on a nuclear site.
- State acceptance of IAEA designations of inspectors and issuance of multiple entry visas (valid for at least one year) for inspectors.
- State provision of information about, and Agency verification mechanisms for, a state's research and development activities related to its nuclear fuel cycle.
- Agency right to make use of internationally established communications systems, including satellite systems and other forms of telecommunication.
- State provision of information on the manufacture and export of sensitive nuclear-related technologies, and IAEA verification mechanisms for manufacturing and import locations in the state.
- Wide area environmental sampling, after Board approval of procedural arrangements for such sampling and after consultations with the state concerned.

Source: Cooley (2003: 32).

Once the extent of Iraq's progressive violations became known in 1991 through inspections by the IAEA's Iraq Action Team (Blix, 2005: 23–25), the Agency responded quickly — at least in UN terms — to reform safeguards. Pro-safeguards governors, in league with Secretariat personnel who had long sought to strengthen their verification tools, used this window of opportunity to push reform through to an extent that was previously unthinkable.[14] In October 1991, the BoG asked the Standing Advisory Group on Safeguards Implementation (SAGSI) to make recommendations for improving the "cost-effectiveness" of safeguards. In response to SAGSI's April 1993 report, the BoG asked the Secretariat to examine the legal, technical and financial aspects of strengthened safeguards and make recommendations. The DG told the Board, in November 1993, that the Secretariat would, after assessing, developing and testing SAGSI's recommendations, be ready by early 1995 to make proposals for an improved safeguards system. The BoG, taking the Secretariat at its word that the reforms would be ready in two years, endorsed the so-called "93+2 program" in September 1994.[15]

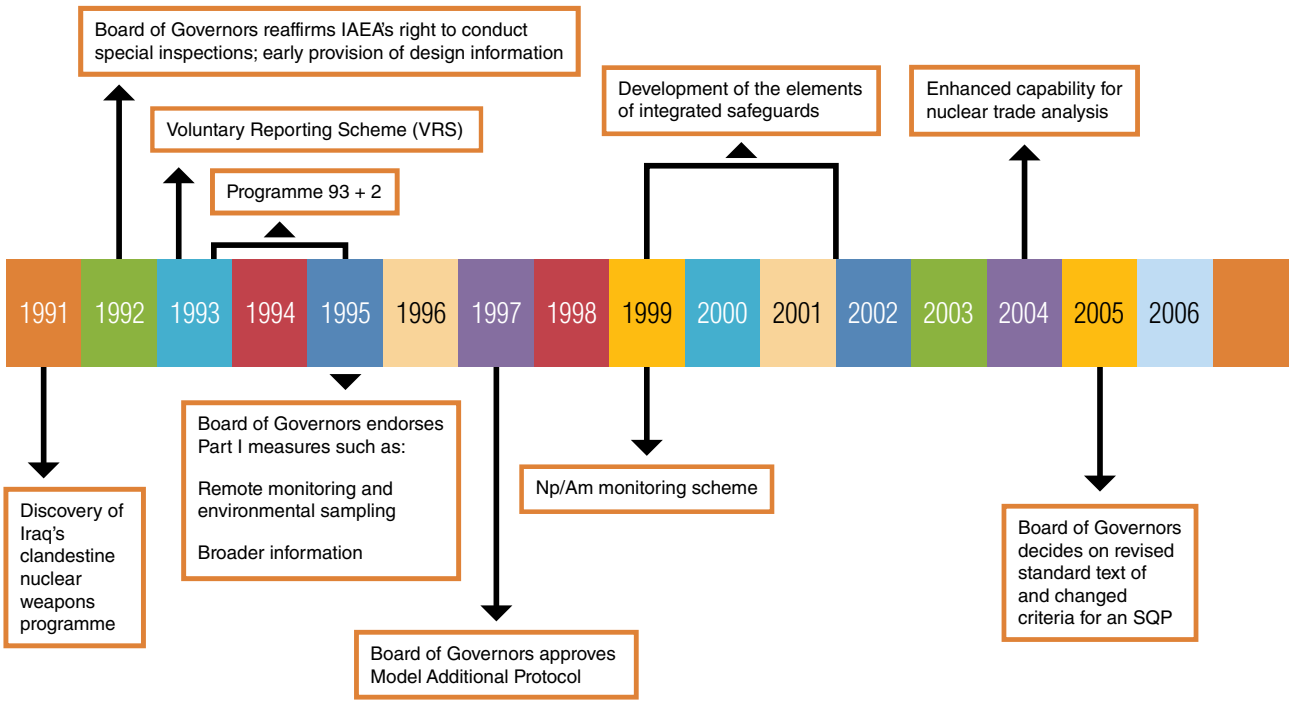
14 Then DG Hans Blix notes that a "sharpening of the safeguards system…now became possible, which it had hardly been earlier" (Blix, 2005: 24).

15 However, in the interim several measures were taken immediately to obtain greater access to safeguards-relevant information and locations (IAEA, 2006h).

In February 1992, the Board reaffirmed the Secretariat's right to conduct special inspections and approved a Secretariat proposal whereby states would be required to provide the Agency with nuclear facility design information at a much earlier stage than previously. It also affirmed in February 1992, that the scope of CSAs was not limited to nuclear material actually declared by a state, but included any material that is required to be declared (IAEA, 2007a).

In February 1993, the Board endorsed a Voluntary Reporting Scheme that would expand information available to the Secretariat on the import and export of nuclear material not already required to be reported under safeguards agreements, and on the export of specified equipment and non-nuclear material. In September 1999, the Board also approved a voluntary scheme for monitoring the proliferation risk posed by separated neptunium and americium, under which selected states were requested to report their holdings and exports, if any, and states' facilities capable of carrying out neptunium separation processing were asked to agree to a "flow-sheet monitoring" arrangement with the Agency (IAEA, 2006h). During 2010, the Secretariat received information from 12 states and the European Commission about such materials (IAEA, 2010d).

Figure 6: Development of the Safeguards System Since 1991



Source: IAEA (2007a: 30).

The overall objective of strengthened safeguards, as endorsed by the BoG, was to develop a safeguards system that could verify not only the "correctness" of states' declarations of nuclear material, but their "completeness." The Agency should be able to provide credible assurances not only of the non-diversion of nuclear material from declared activities, but also the absence of undeclared nuclear material and activities from states' declarations. This would require new levels of cooperation from each state in addition to enhanced Agency capabilities.

Strengthened safeguards were accomplished in two parts. Part one comprised measures the Board concluded the Agency already had the legal authority to undertake, and which could be implemented immediately. These included requesting additional information from states on their former and future nuclear facilities, increased use of unattended monitoring devices transmitting data direct to IAEA headquarters, expanded use of short-notice and unannounced inspections at declared facilities, and the introduction of environmental sampling at sites to which the Agency already had access. In addition, the Agency was able to expand its use of open-source information, including satellite imagery (increasingly available commercially), as well as accepting intelligence information from member states. Part two involved negotiating a supplement to states' comprehensive nuclear safeguards agreements, to provide legal authority for further safeguards measures.

The Additional Protocol

It took until May 1997 for the BoG to agree on the Model Additional Protocol (AP) (IAEA, 1997b), which expanded the verification responsibilities of both the Agency and each state party. By this stage, the shock of Iraq's action was wearing off, and members were reverting to their previous knee-jerk reactions to reform. Nonetheless, the Protocol provides for increased transparency by extending the obligations of states to declare, report and grant on-site access to their entire range of nuclear fuel cycle activities — from mining to the disposition of nuclear waste. The AP also requires states to report nuclear-related equipment production, nuclear-related imports and exports, nuclear fuel cycle-related research and development, and future plans for nuclear facilities. "Complementary access" could be sought by inspectors to resolve ambiguities discerned at both declared and undeclared sites. Parties are required to provide an expanded declaration of their nuclear activities within 180 days of entry into force of their AP.

The AP enables the IAEA to develop a holistic view of states' nuclear activities, as opposed to one that is based solely on materials and facilities — quite a turnaround from the previous system. As former DG ElBaradei noted: "Strengthened safeguards facilitate the Agency's new-found objective of providing credible assurance not only about declared nuclear material in a State but also about the absence of undeclared nuclear material and activities" (IAEA, 2002a: 2). The

strengthened safeguards system has, to an extent, liberated the Agency from its past timidity, both mandated and self-imposed, and emboldened it to examine the entire range of "signals" of a proliferator's intentions. It is notable, for instance, that the Agency has concerned itself with evidence of the links between Iran's military and its alleged peaceful nuclear program, something it previously would have felt was beyond its official verification remit. This has not been specifically approved by the BoG: rather, the Secretariat has taken this activity upon itself as a logical extension of its concern to prevent the proliferation of nuclear weapons by NNWS — specifically on the grounds that indications of weaponization suggest that not all nuclear material may be confined to peaceful uses.

A major challenge faced in implementing the AP, however, is that it is voluntary, making it likely that only those states intent on complying will adopt one without pressure. Contrary to widespread misunderstanding, the AP is not a stand-alone treaty and is not a protocol to the NPT, but rather a model that is the basis for negotiation of an individually tailored version between the Agency and each state with a safeguards agreement (to which the AP is appended). Each AP is subject to approval by the BoG, and signature and ratification by the state before it enters into force. This partly explains the delay in the widespread adoption of the AP.

The Agency has undertaken significant efforts to promote accession, including regional workshops, but progress has been slow (IAEA, 2008g; IAEA, 2011x) and, ultimately, it is the sovereign decision of each member state. Calls have been accumulating for the AP to be made a condition of nuclear exports (ICNND, 2009: 86), and the NSG has already done so for items on its control lists (Horner, 2011: 29-30). There have also been mounting calls to declare the AP to be declared the "standard" (WMDC, 2006: 173 [Recommendation 54), the "accepted minimum standard" (WMDC, 2006: 53) or the "gold standard." Australia describes it as the standard already (Carlson, 2011). The new Non-Proliferation and Disarmament Initiative, made up of nine countries — Australia, Chile, Germany, Japan, Mexico, the Netherlands, Poland, Turkey and the United Arab Emirates — seeking the total elimination of nuclear weapons, regards the AP in this light (Rudd et al., 2011; Woolcott, 2011). So far, Australia is the only country that insists on the AP as a condition of uranium supply.

Given that the AP is being adopted by an increasing number of states, it is in fact becoming the de facto standard. The truly revolutionary step would be for the BoG to make it mandatory, but there is also strong opposition to such a move both in the BoG and within the IAEA membership generally, notably by those states that have no intention of adopting one voluntarily, such as Brazil, Egypt, Iran and Pakistan.

CURRENT PARTICIPATION IN SAFEGUARDS

The status of IAEA safeguards at the time of writing, according to the IAEA website (www.iaea.org), was as follows. One hundred and seventy-eight states, plus Taiwan and EURATOM, had safeguards agreements in force. CSAs were in force for 108 states (and EURATOM). Despite their legally binding obligation to do so, 14 NPT states parties, mostly African and small island states, did not have them in force. Six had signed a CSA, two had draft agreements approved by the BoG but not yet signed, and six had not yet submitted CSAs to the BoG. For states without a CSA in force, the IAEA is unable to draw any safeguards conclusions and is, therefore, unable to determine if they are in compliance with the NPT. One hundred and fifteen states (and EURATOM) had an AP in force, 23 had signed one and another two had agreements approved by the BoG. Several states with significant nuclear activities had not yet concluded an AP, including Argentina, Brazil, Egypt, Iran and North Korea. Fifty-one states still had old Small Quantities Protocols (SQPs) in force, 12 had the new version in force, 42 others were in the process of converting from the old to the new, and three, Ghana, Jamaica and Morocco, had replaced them with APs. Forty-eight states have qualified for Integrated Safeguards (IS).

In the meantime, the Secretariat should insist on more thorough verification in states without an AP as an inducement to adopt one. It seems counterintuitive to impose a greater verification burden on a state that is willing to be more open and transparent about its nuclear activities than one that is not. The BoG could reinforce this by signalling to states that only have a CSA (and without a reinforcing regional safeguards system such as EURATOM or the Argentine-Brazilian Agency for Accounting and Control (ABACC)) that they can expect intensified scrutiny.[16]

Small Quantities Protocol

A significant number of states have an SQP (IAEA, 1974) also appended to their CSA, which holds in abeyance most comprehensive safeguards obligations, including declarations and inspections, while nuclear activities remain under a certain low threshold. Controversy over SQPs arose when some BoG members expressed concern that Saudi Arabia, a state with significant nuclear energy ambitions, would not be providing enough transparency through its traditional SQP (IISS, 2008: 42).

In September 2005, the Board directed the Agency to begin renegotiating SQPs to increase at least some of the IAEA's powers,

16 ABACC safeguards are regarded by experts as not having quite the same verification credibility as those of EURATOM.

based on a revised model agreement (IAEA, 2006j). The new model obliges states to submit a declaration of their nuclear holdings, however small, which in turn forces them to institute an SSAC. The new SQP is unavailable to a state with an existing or planned facility, and reinstates the Agency's right to conduct ad hoc and special inspections (IAEA, 2010d: 4). States with existing SQPs were invited to swap them for new ones, while all future SQPs will be based on the new model.

The new SQP should be especially useful in strengthening national measures to avoid theft and illicit trans-shipments of nuclear material (Lodding and Ribeiro, 2007: 1–4). However, the initiative is, again, dependent on the goodwill of the states concerned and is proceeding slowly. Ideally, all states seeking a nuclear energy program should, as soon as possible, swap their SQP for a CSA and an AP.

Integrated Safeguards

In addition to strengthening safeguards, the Agency has also moved to rationalize the layers of safeguards that have been imposed on states over the years, thereby increasing efficiency (and, it is hoped, effectiveness) by instituting the concept of IS (Boureston and Feldman, 2007). A specific IS approach is developed for each state that has both a CSA and an AP in force. An IS approach can be implemented when the Secretariat has been able to draw the Broader Safeguards Conclusion that a state has, for a given year, "all nuclear material remained in peaceful activities" (IAEA, 2007a: 14).

Implementation of an IS is, thus, partly a reward for punctilious compliance with all aspects of safeguards, including an AP (although this is not how the Agency expresses it), as states must undergo rigorous examination (and cross-examination) to qualify. This process sometimes lasts for several years, depending on the size of a state's nuclear industry. An unspoken benefit for the IAEA is that its verification resources can be devoted to other more problematic cases. While this runs the ever-present risk of charges of discrimination, to date there have been no difficulties raised by IAEA member states. On the contrary, despite the rigours of the process (most states take many years before they are given the all-clear), member states seem to appreciate the resulting benefits. By the end of 2009, the Agency was achieving savings of approximately 800 inspector days annually, or about 10 percent of the total.[17] In any one state, savings of between 30 percent to 40 percent were possible.

State and Regional Systems of Accounting and Control

The State System of Accounting and Control (SSAC) is the organization within the state that typically has both a national objective to account for, and control, nuclear material in the state and an international role in providing the basis for IAEA safeguards. Regional Systems of Accounting and Control (RSACs), EURATOM and the ABACC fulfill the same functions regionally. Each state party to a CSA is required to establish and maintain a SSAC. SSACs and RSACs are also the chief point of contact between the state and the IAEA for operational issues (IAEA, 2007a: 20), such as installing equipment and scheduling unannounced inspections. In addition, although the Agency does not say so explicitly, the SSAC will be the initial port of call for questions or concerns that the Agency may have about a state's non-compliance.

The role of SSACs and RSACs are underappreciated by outside observers, but clearly, safeguards could not function without close cooperation between these organizations and the IAEA. The Agency explicitly says that the effectiveness and efficiency of IAEA safeguards "depends, to a large extent," on the effectiveness of these arrangements (IAEA, 2011cc: 7). Not only safeguards, but nuclear security, including the prevention of nuclear terrorism, is also dependent on SSACS that function properly, since they ensure that all nuclear material is accounted for and secured. It is in the Agency's interests, therefore, to strengthen these systems as much as possible.

The Agency's 2010 Safeguards Statement noted that "some" states[18] do not have SSACs. Moreover, not all of them have the necessary authority, independence from operators, resources and technical capabilities to carry out their mandate effectively. Most troublingly, some SSACs fail in their fundamental mission to "impose and verify proper nuclear material accounting and control systems at nuclear facilities and locations outside facilities (LOFs) to ensure the required accuracy and precision of the data transmitted to the Agency" (IAEA, 2010d: 11).

The Agency has a "comprehensive project" (IAEA, 2007a: 19)[19] to assist member states with their SSACs. This includes the IAEA SSAC Advisory Service, which provides states, on request, with advice and recommendations on the establishment and strengthening of SSACs. International Team of Experts advisory missions may be dispatched to an IAEA member state at its request, to inform national policy makers about the need for states to adhere to the international legal framework governing nuclear material, and how to implement it domestically. Between 2002 and 2011, 13 such missions had been requested and conducted (IAEA, 2012b: 15), which seems low, in view of the number of states with safeguards agreements. In addition to facilitating the implementation of safeguards, the service contributes to safety and security by ensuring that states can adequately account for their nuclear material. The Agency also provides training to SSAC and RSAC personnel (IAEA, 2011cc: 7). Finally, the Agency assists states in drafting national implementation legislation to ensure proper national systems of accounting and control, not just in furtherance of nuclear safeguards, but also pursuant to UN Security Council Resolution 1540 (UN, 2004c).

17 Presentation by Nobuiho Muroya, Director, Division of Operations C, Department of Safeguards, IAEA, to Wilton Park Conference 1008 on Nuclear Non-Proliferation and the 2010 Review, December 14–18, 2009.

18 The exact number and names of the countries concerned are not publicly revealed.

19 Apparently it does not have a name.

ROLE OF SAGSI

Established in 1975, SAGSI had its origins in a 1971 proposal by Japan for an "oversight" safeguards committee of the Board (Fischer and Szasz, 1985: 67). But instead of SAGSI being a BoG subsidiary body, it is an advisory body to the DG. According to John Carlson, chair of SAGSI from 2001 to 2006, it "has made a major contribution to the evolution of the safeguards system" (Carlson, 2006b: 1). Carlson describes its role as being: "to provide an independent peer review of Secretariat proposals and activities; to function as a think tank, anticipating and analyzing major safeguards/verification issues; and to promote support and understanding by governments and the safeguards community of the IAEA's proposals and activities" (Carlson, 2006b: 2). In the more prosaic words of a British official, it is meant to be a sounding board for "sometimes wild and wacky ideas," which if aired publicly, might embarrass all concerned.[20]

SAGSI's members are appointed by the DG on a personal basis, but clearly represent the most powerful interests in the IAEA's membership. Currently, it comprises experts mostly drawn from the United Kingdom, the United States, Japan, Brazil, Australia, South Africa and Germany. Its Working Groups, which currently meet several times a year, tend to formulate ideas for the approval of the SAGSI plenary and inclusion in its report to the DG. It also does some intersessional work, for example, on the SIR, but this often leaves developing countries' representatives out, as they cannot afford to attend all meetings (participation is paid for by the delegate's own country, although the Agency will fund some developing country attendees).

SAGSI's contributions over the years have included helping the Secretariat develop safeguards "detection goals," the reporting format for safeguards performance (the SIR), a number of the reforms included in the 93+2 program, integrated safeguards concepts, including the State Level Approach, and information-driven safeguards. SAGSI does not investigate technology per se, but rather the implications of new technology. SAGSI has, for example, been advocating for more detailed SIRs, along the lines of those issued by ICAO regarding airport safety and security.

SAGSI's proceedings are confidential in order to preserve a free exchange of ideas, but this also reinforces the lack of transparency about safeguards, which characterizes the Agency's general approach. In the past, the BoG was given regular outlines of SAGSI's agenda and work, but this practice was discontinued in 1989 (Carlson, 2006b: 4). Consideration should be given to reviving it. More broadly, the work of SAGSI is largely unknown. There is no description of it on the IAEA website (David Fischer's 1997 history of the Agency does not even mention it) and there is little publicity about its activities, except at specialized conferences such as IAEA safeguards symposia.[21]

The BoG has tried to set up its own advisory committee in this area. Established by the BoG at the suggestion of the United States in June 2005, the Advisory Committee on Safeguards and Verification was wound up after six meetings held over two unproductive years (IAEA, 2007f). The Secretariat prepared several useful briefing notes and proposed 18 specific improvements that the Committee might recommend to the BoG (IAEA, 2006g), notably in the areas of environmental sampling and satellite monitoring, and nuclear procurement, but the Committee, which operated by consensus, was unable to even adopt a work plan.

This was partly due to indifferent chairpersonship[22] and a failure by the United States to follow up on its initiative. It was also due to the poor international atmosphere caused by the Coalition invasion of Iraq, the failure of the NPT Review Conference in 2005 and the hostile attitude of the administration of President George W. Bush to multilateralism generally. The Iranian delegation refusal to permit consensus and its introduction of extraneous issues such as the lack of progress on nuclear disarmament also played a large role in the committee's demise. The DG at the time, Mohamed ElBaradei saw the committee as useful in principle, but, revealing his own prejudices, felt that its real intent was a US desire to "micromanage" the work of the Agency "and particularly to force a hard-line approach on Iran's nuclear program" (ElBaradei, 2011: 174).

From the final report of the chair, it is clear that the committee spent a great deal of time debating what safeguards improvements were permitted "within the framework of the IAEA Statute" (as if the Agency had not evolved since the Statute) and were considered by the Secretariat to be "legal" (mandatory), and those that were considered "voluntary." Unfortunately, all of the recommendations were contingent on the BoG making a decision; none could be implemented by the Secretariat by itself. As ElBaradei states, "after a series of rather nondescript meetings," the Board allowed Committee 25 (the Advisory Committee on Safeguards and Verfication), in the words of one of the ambassadors: "to die a quiet and natural death" (ElBaradei, 2011: 175). With the Iranian non-compliance case still unresolved, it is not clear if there would be any point in trying to resuscitate this committee or for the Board to attempt a similar exercise at this time. The politics are not favourable.

THE IMPACT OF THE CASE OF IRAN

Since 2003, the IAEA has been embroiled in a continuing struggle with Iran, in order to determine the precise details of Iran's past non-compliance with its safeguards agreement (and the NPT), and to reassure itself that there is no further undeclared nuclear activity. Iran's clandestine uranium enrichment program was not detected by the Agency, reinforcing the view that the old safeguards system (which had failed to uncover 18 years of non-compliance by Iran) had been grossly inadequate. The list of infractions of Iran's safeguards agreement was long, ranging from laboratory

20 Interview with the author, London, October 2011.

21 For example, a PowerPoint presentation on November 3, 2010 by then-SAGSI Chair James Casterton on "The Further Evolution of SSAC/IAEA Cooperation: SAGSI's Considerations."

22 The chair was Algerian Governor Ms. Taous Feroukhi.

experiments with plutonium and HEU, through the construction of undeclared nuclear facilities, to studies of weapons designs and testing of weapons-related components.

The Iran case has had mixed outcomes for the Agency and its safeguards system. Although it has been taxing on the Secretariat, it has also enabled it to demonstrate the power of strengthened safeguards, even in a state that does not adopt an AP. Although Iran initially said it would act as if it had an AP in place, it subsequently withdrew that undertaking, and refused to adopt one, presumably because it had proved too effective in revealing information that Iran wished to conceal. Even though Iran has not been entirely cooperative, it has become one of the most inspected IAEA member states and has been obliged to engage with the Agency, more or less continuously, in an attempt to convince the Agency to close its case (which the Agency never does for any state, no matter how apparently compliant).

The extra information requirements and increased Agency powers resulting from strengthened safeguards have proved potent in providing leads for the Agency to pursue, through requests for further information and follow-up inspections. Environmental sampling has also proven to be illuminating. The Agency has, in addition, been able to put open-source information, intelligence information from member states and its pursuit of leads through interviews to good effect. William Walker concludes that, in Iran, the IAEA has demonstrated that (2012: 116): "…it could build up an impressive knowledge of a state's nuclear activities even when there were attempts to disguise them. Where knowledge was incomplete, it would at least become aware of the incompleteness and of the steps required to attain compliance. This inevitably drew the IAEA towards the realm of intelligence gathering" (Walker, 2012: 116).

Perhaps most amazingly, the IAEA has extensively investigated evidence of weaponization and the link between Iran's military and its alleged peaceful nuclear program, something the Agency previously would have felt was beyond its remit. The Secretariat has done this without seeking BoG permission, but based on UN Security Council resolutions asking Iran to cooperate fully with the Agency in regard to "the possible military dimensions" of Iran's nuclear program (UN Security Council, 2010: para. 3). The Secretariat has also used the argument that evidence of weaponization activities can also imply that not all nuclear material is accounted for and being applied exclusively to peaceful purposes. The November 2011 report on Iran by the DG to the BoG contained by far the most detailed account of an alleged weaponization program that the Agency has ever prepared (IAEA, 2011p).

The current standoff with Iran is not a failure of the current safeguards system so much as a failure of the mechanisms for dealing with non-compliance once it is discovered. Both the BoG and the UN Security Council are to be faulted for this (see the section on compliance below for further analysis). The situation has, however, had deleterious consequences for further improvement of safeguards. Iran, suspicious that any improvement in safeguards is targeted at it, pursues every means to halt any advances. Notably, it helped sabotage the BoG's Advisory Committee on Safeguards and Verification, which survived for just two years, from 2005 to 2007. Iran also takes every opportunity to advance its own cause, and has put the Secretariat and the DG under great scrutiny on all issues, whether directly relevant to Iran or not. Iran has increasingly helped sour the atmosphere in the BoG.

CURRENT SAFEGUARDS ISSUES AND CHALLENGES

The strengthened safeguards system is, undoubtedly, a significant improvement on previous arrangements, increasing the costs and risks for a potential proliferator, and raising confidence in the ability of the Agency to achieve timely detection. It has also, to some extent, liberated the IAEA from its past timidity, both mandated and self-imposed, and emboldened it to examine the entire range of "indicators" and "signatures" (it even uses this language) of a proliferator's non-compliant activities. The Agency is deliberatively collecting and analyzing open-source information; accepting intelligence information from member states obtained through so-called National Technical Means (NTM),[23] while recognizing its limitations; and seeking to overturn some of the mechanistic aspects of inspection and other practices that in the past produced institutional blindness.

The following section considers the current state of safeguards, the continuing debates and issues about their efficacy, and the possibility of further strengthening and reform. It is important to note, however, several caveats about the ultimate utility of safeguards in preventing nuclear proliferation:

- The Agency cannot deal with the difficulty that an NPT state party can, perfectly legally, under safeguards, accumulate the panoply of fuel cycle capabilities, nuclear materials and expertise necessary to build nuclear weapons and then leave the Treaty giving just three months' notice with a declaration that it considers its supreme interests to have been jeopardized (IAEA, 1970: Art. X).
- Determining the effectiveness of safeguards, despite noble attempts at establishing technical criteria and objective decision-making processes, ultimately involves subjective judgments; safeguards notably cannot usually detect a state's intentions (although in some cases it can, for example through the discovery of documents indicating plans for weaponization, deployment or use); this leads to legitimate debate among experts as to the correct approaches needed.

23 NTM is a euphemism for all sources of information obtained by a state for monitoring the behaviour of other states, including in respect of treaty compliance. This includes human intelligence gathering (spying), electronic signals intelligence, satellite imagery and other forms of remote monitoring. For further details see Verification Research, Training and Information Centre (VERTIC), 2003: 20–22.

- Ultimately, nuclear safeguards are only as good as the IAEA membership allows them to be, especially in terms of providing political, technical and financial support.

Safeguards Department's Strategic Plan

In 2010, the IAEA's Safeguards Department finalized its first-ever Strategic Plan. Spanning 10 years from 2012 to 2023, the Plan is the first devised by an Agency department. Eighteen months in the making, involving intensive consultations within the Department, it was drafted by a Strategic Planning Team. It employed a SWOC (strengths, weaknesses, opportunities, capabilities) analysis and developed a risk assessment model (Pujol, 2010). The exercise is unprecedented for the Agency and virtually unheard of in UN-related organizations. Although the Strategic Plan is confidential and considered for internal departmental use only, presentations by Agency personal have revealed its broad outlines and content.

The particular strengths of the Safeguards Department were identified as: its unique legal mandate; its predictable funding from the regular budget; its expertise, know-how and experience; its multicultural dedicated staff; the improvements it had made through quality management; its new strategic planning framework and member state support programs. Departmental weak points included: a "non-uniform" legal authority with weaknesses (presumably the varied legal authorities vis à vis member states); a stretched budget; "implementation issues" (although it is not clear whether these are issues attributable to the department or to member states); "sometimes" inadequate expertise; recruiting difficulties; lack of information analysis tools; and "room for improvements" in interdepartmental cooperation, coordination, communication and "culture" (Pujol, 2010). The risk assessment involved risk identification (61 risks were identified) and evaluation of the level of risk (likelihood of a risk eventuating multiplied by the consequences); and categorization of the risks (most were judged to be high and medium). External risks identified were, among others:

- the potential expansion in the use of nuclear energy;
- globalization and the expanding nuclear trade (licit and illicit);
- science and technology innovation (nuclear and general); and
- a challenged non-proliferation regime (non-compliance and "political divisions"); and new IAEA roles and activities.

The Strategic Plan is a remarkable document to the extent that it broadens the Safeguards Department's role from implementing, in the most effective and efficient way, the old nuclear safeguards system, as narrowly conceived and defined, to a much wider set of strategic objectives:

- to deter the proliferation of nuclear weapons, by early detection of the misuse of nuclear material or technology, and by providing credible assurances that states are honouring their safeguards obligations;
- to contribute to nuclear arms control and disarmament, by responding to requests for verification and other technical assistance associated with related agreements and arrangements; and
- to continually improve and optimize departmental operations and capabilities to effectively carry out the IAEA's verification mission.

While these are unobjectionable, the first two objectives are in reality what the IAEA as a whole should have among its strategic objectives — if it had a proper strategic plan. Remarkably the first — deterring nuclear proliferation — is not included in the Agency's newly adopted Mid-Term Strategy 2012–2017.

The Safeguards Department envisages a review every two years of the external environment that may have an impact on its Strategic Plan, and a review every six years of the Department's performance, leading to an updated 12-year plan. The Strategic Plan is thus meant to be a "living document." Again, this is unprecedented for the IAEA and, possibly, the UN system as a whole.

Although most of the specifics of the Strategic Plan are familiar, given that they are continuations of existing programs for strengthening nuclear safeguards, there are several goals that seem to be aimed at improving the Department's performance. Several of these relate to human resources, including: better intra-departmental communication and collaboration, addressing structural, technical and cultural aspects; conducting continual workforce planning, anticipating trends, identifying needs and building human resource strategies; improving staff recruitment, to make it more "pro-active, smarter and efficient"; and training and developing the current and future workforce. Other significant goals envisage sharing experiences and good practices with other organizations and entities that are combating the proliferation of nuclear weapons and other so-called WMD, "as appropriate."

A whole section of the Strategic Plan is commendably devoted to the goal of communicating with stakeholders and the public. Paradoxically, but perhaps understandably, the Department insists that the document is intended for internal purposes and is best kept that way (presumably lest member states seek to tamper with it). The BoG's desultory attempt to craft the Agency's Medium-Term Strategy indicates the pitfalls (see Part Seven: Management and Administration for further details). The Department is planning, however, to release a summary version of the document publicly on the IAEA website. At the time of writing this had not yet occurred.

The anticipated benefits of the Strategic Plan, according to Director of the Division of Concepts and Planning Jill Cooley, include permitting the Department to engage in long-range planning according to agreed goals and objectives, providing better information to member states, supporting internal decision making about priorities and allocation of resources (always a struggle in any

organization), and unifying departmental planning, monitoring and evaluation activities under one framework (Cooley, 2010). The greatest benefit, however, may already have been gained — namely, the engagement of all safeguards divisions (and personnel) in preparing the plan and thereby promoting strategic thinking about the Agency's future challenges.

New Safeguards Concepts and Approaches

As part of the strengthened safeguards process, the Agency is now pursuing what it describes as truly "information-driven" safeguards (IAEA, 2007a: 16). This is an objectives-based, not criteria-based, state-level approach. The old criteria-based approach adopted had deteriorated into a mechanistic box-ticking exercise, detached from the overall objectives of safeguards. The new objectives-based approach focuses on the purpose of inspections, based on continuous state evaluation, all available information sources and the results of previous inspections. It allows the individual inspector more leeway in considering how the purpose of an inspection might be accomplished. Improving the effectiveness and cooperativeness of the SSACs and their regional equivalents is also a major new emphasis.

As of 2011 (IAEA, 2011cc: 4),[24] each state under safeguards is now subject to continuing, collaborative analysis by a multidisciplinary State Evaluation Group, a country team of Agency personnel, drawing on all of the information available to the Agency about that state. The three main sources of information are (IAEA, 2007a: 15): states under safeguards agreements and APs (including information provided voluntarily); IAEA in-field verification activities; and open and other sources. The latter includes satellite imagery, intelligence information from member states and nuclear trade-related information from states and companies. In addition, there is a long-term intention to replace human inspectors, where possible and appropriate, with remote monitoring technology, which is becoming more capable and reliable, although to date this has mainly been done as a cost-saving measure. The Agency continues to see human inspectors as its greatest verification resource but aims to use them more "wisely."

The state-level approach focuses on the state as a whole, considering all relevant information, rather than the previous concentration on nuclear materials and facilities. Verification activities are tailored to each state and are subject to review. For instance, a number of states that achieved integrated safeguards at an early stage in the development of that program are now due for a review of the verification measures applied to them to ensure that verifiability remains assured.

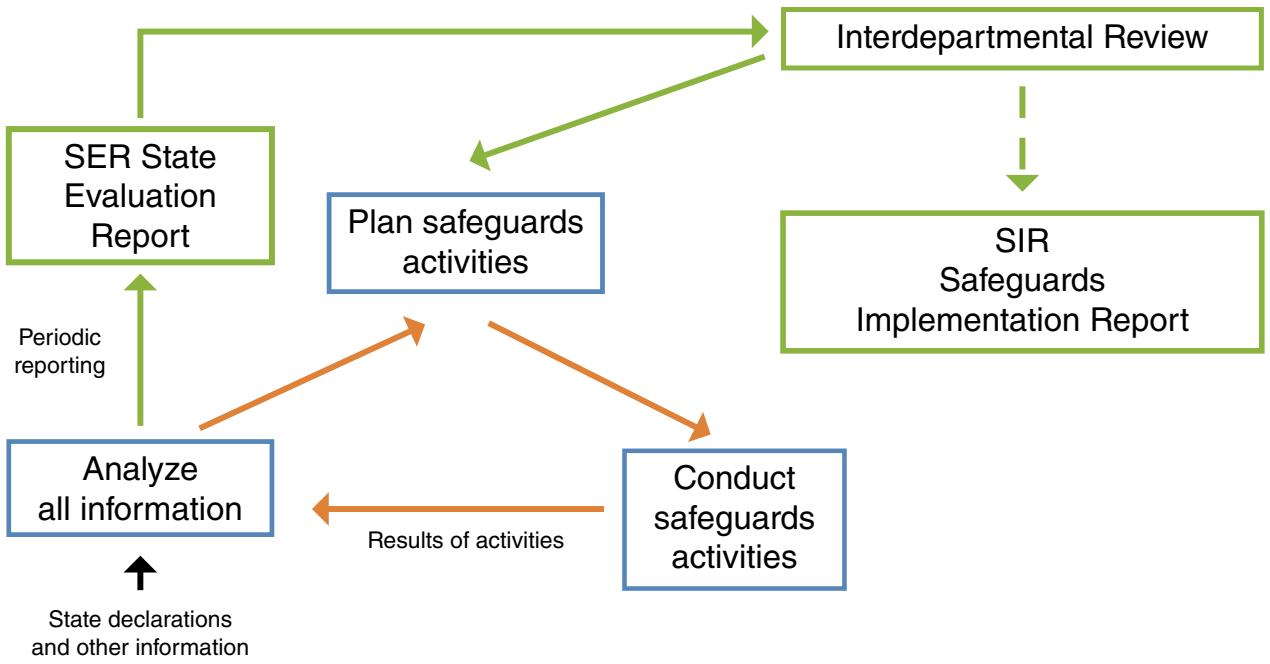
State evaluations are recorded in an internal document known as a State Evaluation Report (SER). Each builds on the previous one, and takes into account new information as it becomes available. More information is now being included in SERs and there is an increasing effort to create a feedback loop between the SER and verification, so that each informs the other. A dedicated, high-level interdepartmental committee reviews the content of all SERs, as well as the process followed during the evaluation. There are also, the Agency reports, quality control mechanisms being put in place for reviewing evaluation methodology, guidelines, resources and information sources, and for improving the evaluation and review system in light of experience, technical advances and changing requirements (IAEA, 2007a: 16). The review committee makes the final decision on the conclusion for each state that will be reported in the annual Safeguards Implementation Report (SIR) to the Board. The full SIR is confidential, but portions are released publicly as part of an annual Safeguards Statement (IAEA, 2010d). Serious concerns about non-compliance by a particular state are reported to the BoG and/or to the UN Security Council (in response to special requests or mandates).

While the new system is deliberately being designed to evolve over time, an attempt is being made to implement the most significant changes by the end of 2012. Former SAGSI Chair and veteran officer of the CNSC James Casterton has been put in charge of "change management," in order to accelerate the process, including "integrating" all inspectors into the new system and revising guidance documents.

In the meantime, the Department has been testing an inspection concept using new combinations of existing techniques and technologies, such as remote monitoring, unattended measurements and unannounced or short-notice inspections. It also continues to implement what it calls its "quality management system" (although how this relates to the Results-based Management (RBM) and Core Best Practices (CBP) concepts apparently operating in other parts of the Agency is unclear).

24 The Agency also maintains regional offices in Tokyo and Toronto.

Figure 7: State Evaluation Is a Continuous Process



Source: IAEA (2007a: 16).

Safeguards Data Management and Collection

One of the challenges of the new information-driven safeguards system is the need to handle increasingly large volumes of data utilizing a modern "knowledge management system," including a database that records the experiences of all safeguards inspectors. A further feature is to integrate information from all departments of the Agency (with potential benefits for ameliorating the Agency's tendency to "stovepipe" information).

The Agency is in the process of re-engineering the IAEA Safeguards Information System (ISIS), with specific aims to provide: immediate and secure online access to information that inspectors need, whether at headquarters or in the field; the Secretariat with the capability to analyze all information available; and an adaptable infrastructure that can respond to future needs (IAEA, 2007a). Role-based access controls have been introduced for staff who need to access confidential information. Information stored on the old IAEA mainframe has been migrated to the ISIS. In 2010, in a long-sought-after reform, the Safeguards Analytical Laboratories (SALs) were incorporated into the Safeguards Department, thereby placing the coordination of all analytical services under the control of its biggest customer, with the aim of achieving more effective and efficient program management.

Changing the Safeguards "Culture"

A key part of the new approach to safeguards is changing the existing "culture." Inspectors are increasingly encouraged to take the initiative to resolve issues on the spot, rather than automatically seeking advice from headquarters, to be more willing to engage with plant operators and state representatives, and to use their critical faculties to assess compliance beyond the previously narrow confines of nuclear accounting. It is recognized that inspectors need to be allowed to think for themselves and to make mistakes. This applies not just inspectors, but also to safeguards managers and analysts, who also need to absorb the new system, which is more complex, more iterative, constantly evolving and renders old skill sets either outpaced or irrelevant. The Agency itself speaks of "developing a new mindset and culture" (IAEA, 2007a: 27). "Soft skills" such as observation and listening skills are being promoted and appropriate training provided. The United Kingdom, for instance, is providing, through its Member State Support Program (MSSP), training in diplomatic skills for inspectors.

Given that the major shortcomings of safeguards became evident 21 years ago, it is clear that the human dimension of safeguards has been the most difficult part of the old system to re-engineer. There remain concerns among member states, especially Western group members, and within the Secretariat itself, that the IAEA inspectorate's

culture has still not changed sufficiently.[25] The Agency is coping with a significant legacy issue: managers and inspectors who advanced their careers through the old system have often been reluctant or unable to change. Turnover in the inspectorate is relatively constant, but slow, and it is likely that an entire generational change needs to occur before the culture can change completely.

Safeguards Detection Goals and Bulk Handling Facilities

One issue that has arisen repeatedly over the years is the utility of the Agency's now 30-year attempt to quantify and objectify the "detection goals" of safeguards. These goals were developed by SAGSI as its first task in 1975, and have been implemented by the Secretariat ever since with "provisional" Board endorsement for the purpose of inspection planning (Scheinman, 1987: 166).

Most controversial is the concept of "Significant Quantities" (SQs), defined as "the approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded" (IAEA, 2001a: 23). These are 8 kilograms of plutonium or uranium-233, 25 kilograms of uranium-235 enriched to 20 percent or more, 75 kilograms of uranium-235 enriched to less than 20 percent, 10 tonnes of uranium or 20 tonnes of thorium. The Agency has always cautioned that SQs "do not take into account unavoidable losses due to conversion and manufacturing processes and should not be confused with critical masses," the precise amount of material for a single nuclear device, especially one constructed by a first-time bomb maker. SQs were to be used to establish the "quantity component" of inspections goals, since zero would have been impractical.

As Larry Scheinman notes, they also need to be seen in the context of the concepts of timely detection (detection time) and detection probability. "Timely detection" is quantified in terms of the time necessary to convert material such as plutonium and HEU into metallic components suitable for a nuclear explosive device. These range from seven to 10 days in the case of plutonium and HEU, to one year for uranium enriched to above 20 percent U-235 or for thorium. As for detection probability, the Agency aims at 90 percent to 95 percent and a false alarm probability of 5 percent or less. These concepts were an attempt to apply quantitative measures to safeguards objectives: "the timely detection of diversion of significant quantities of nuclear material from peaceful nuclear activities to the manufacture of nuclear weapons or of other nuclear explosive devices or for purposes unknown, and deterrence of such diversion by risk of early detection" (IAEA, 1972a: para. 28).

The Agency's problem is, however, that the general public and even the intelligent layperson are apt to treat the SQs as the minimum amount required for a nuclear weapon. They interpret the Agency's safeguards goals as being strict requirements, and conclude that safeguards are thus likely to be inadequate. According to a 1995 report by the US Congress's Office of Technological Assessment (OTA), many analysts regard the SQ thresholds as "probably higher than would be needed by states attempting to make even a first nuclear explosive" (OTA, 1995: 11). The US Department of Energy reinforced this view in 1994 by declaring that 4 kilograms of plutonium are sufficient to make a nuclear weapon (DOE, 1984), although no similar statement was released about HEU.

Of special concern are the facilities that handle material in bulk form, such as powders or solutions, rather than in discrete units such as fuel rods for nuclear reactors (Scheinman, 1987: 166). Such facilities include plutonium reprocessing, uranium enrichment and fuel fabrication plants, especially those producing mixed oxide (MOX) fuel. These facilities handle such large volumes of nuclear material that significant amounts, in terms of the quantities required for an illicit nuclear device, will be unaccounted for — lodged in pipes or other equipment, or subject to accounting and measurement errors. For reprocessing plants, the throughputs are so large (up to 800 metric tons of spent fuel per year), with so much of a plant's operation being automated, that the uncertainties associated with the usual material accountancy methods are likely to be unacceptable. The system is also currently unable to verify overnight adaptation of enrichment and reprocessing plants from declared peaceful purposes, to production of weapons-useable materials.

Critics such as Henry Sokolski, Ed Lyman (2008) and Thomas Cochran point out that, currently, the IAEA is unable to provide timely warning of diversions from such facilities, and for some of these plants, the Agency loses track of "many nuclear weapons-worth of material every year" (Sokolski, 2008: 8). Ed Lyman provides specific examples from Japan, France and the United Kingdom (Lyman, 2008). Cochran suggests that the SQ values for direct-use plutonium and HEU be reduced by a factor of about eight (2008: 123). Sokolski suggests the Agency should publicly admit what it cannot verify (2008: 7-8). Nuclear weapon states, Sokolski says, should be encouraged to make their own individual analyses of these questions and make their findings public.

Yet lowering the SQ and shortening the timeliness values appears unrealistic, since it would increase the inspection burden on the Agency, including by requiring inspections at small facilities in states that do not have nuclear material amounting to a single SQ, as currently defined. Naturally, it would also make it more difficult for the Agency to achieve its inspection goals at facilities where it currently applies safeguards. Since it is already widely recognized that it is difficult to safeguard bulk handling facilities, new techniques to ensure verifiability, such as near real-time accountancy (OTA, 1995: 11) and inspectors permanently stationed on-site will be needed, although even these might be insufficient. In any event, the IAEA would require significant additional resources to achieve verifiability under reduced SQ and timeliness criteria.

25 Although at least two observers believe that most inspectors, while finding the additional tasking involved in the new approach more burdensome, "enjoy the challenge of having to investigate a state's nuclear program in detail" (Boyer and Schanfein, 2008: 112).

Taking into account the difficulty of obtaining significantly increased funding for safeguards, it is not clear that more intensive verification of declared facilities is the best way to enhance the achievement of non-proliferation goals. Some officials argue that in view of the Agency's new approach to safeguards — state-level, holistic and information-driven — it would be possible to actually raise the SQs, since so much more information will now be available about how prone to proliferation each state is likely to be. In any event, the Agency can, in cases where it is concerned about a state's intentions, seek verification below the SQ level.

Further, the effectiveness of safeguards is not to be judged solely from its ability to achieve material accountancy. Many observers note that for successful diversion to occur, the material would have to be physically removed to somewhere where it could be clandestinely used. They note that additional measures can provide extra assurance, including: evaluation and verification of plant design, the adoption of containment[26] and surveillance[27] measures, and the monitoring of plant processes (OTA, 1995: 14). Containment seals, which are increasingly sophisticated, may be used to help achieve this. John Carlson argues that even "overnight" adaptation of facilities to illicit production could be detected if a containment and surveillance system is set up to do so.[28] Scheinman notes, however, there are significant differences within the safeguards community about the role that containment and surveillance can play in reaching safeguards conclusions (Scheinman, 1987: 171).

Finally, the Agency is only too aware of the shortcomings of safeguards on bulk-handling facilities, which is why it is working closely with Japan to apply safeguards to its new Rokkasho-mura Reprocessing Plant (JMOX), the largest commercial reprocessing plant under IAEA safeguards, and the only such facility located in a non-nuclear weapon state.[29] The IAEA, under its JMOX special project, is seeking to devise new approaches that include continuous design verification, advanced safeguards technologies, containment and surveillance, inspectors, and data acquisition and analysis (Pickett, 2008: 170). In its 2010 Safeguards Statement, the Agency says that safeguards approaches for conversion and fuel fabrication plants with significant throughput need to be upgraded to include a short-notice, random inspection scheme for verifying the flow of nuclear material into and out of a facility (IAEA, 2010d: 11). Such schemes were introduced in 2010 for plants in Belgium, Kazakhstan and India, while discussions are being held with Argentina and Brazil for that purpose. The Agency is also emphasizing the possibilities of safeguards by design for new bulk-handling facilities.[30] It is not clear whether these measures will satisfy the critics.

Inspections — Special and Otherwise

Under Agency safeguards agreements, there are three types of inspection: ad hoc, routine and special (IAEA, 2006h: 12). Ad hoc inspections provide access to any location where an initial report, or any inspection, indicates that nuclear material is present. Ad hoc inspections are supplanted by routine inspections at facilities or LOFs, once Subsidiary Arrangements are in place to determine where and when they occur. Special inspections may be carried out, including at "additional locations," to verify information contained in special reports submitted by states, or if the IAEA considers information made available by a state, including explanations from the state and information from routine inspections, is not adequate for the Agency to fulfill its responsibilities under a safeguards agreement. Special inspections are provided for in comprehensive safeguards agreements and, post-Iraq, the BoG in February 1992 reiterated the right of the Agency to conduct them (although cautioning that they should only be used on "rare occasions").

Described in this way, special inspections sound innocuous and hardly much of a step-up from routine inspections. Over time, however, they have come to be seen as the equivalent of a "challenge" inspection in other disarmament regimes, such as under the CWC and the CTBT, which may be requested in cases where there is a strong suspicion of malfeasance. Special inspections may be conducted at locations and facilities far removed from any declared facilities in any part of a state's territory, even at a state's most sensitive military sites. Moreover, while in the CWC and CTBT cases the governing body of the organization votes on a proposal by the Secretariat for such an inspection, in the case of the IAEA it is the Secretariat itself, through the DG, which requests the inspection, with the BoG being kept informed. As in the OPCW and CTBTO cases, the IAEA can use managed access techniques and other procedures to ensure that any special inspection targets only the particular areas and facilities that it needs to.

Since the IAEA Secretariat has formally requested a special inspection at an "additional location" only once — in the highly charged case of North Korea, which refused to accept the request — this type of inspection has assumed epic political proportions. The only other time a special inspection has been formally used is when the Romanian government requested one in 1992 to clarify discrepancies arising from the previous regime (Mozley, 1998: 167). Despite calls for it to do so the Agency has declined to request a special inspection in the case of Syria, which has blatantly refused to grant access or provide sufficient information to clarify whether

26 Containment refers to the use of structural features of a facility, containers or equipment to establish the physical integrity of an area or items, and to maintain continuity of knowledge of the area or items (IAEA, 2001a).

27 Surveillance refers to the collection of information through inspector and/or instrumental observation aimed at detecting movements of nuclear materials or other items and any interference with IAEA equipment, samples and data (IAEA, 2001a: 66).

28 Personal communication with the author.

29 For details of the case, see Pickett, 2008.

30 There is also an emerging idea that safeguards should be applied to unprocessed yellowcake, now that the purity is reaching high levels almost equivalent to processed yellowcake. But, again, this would be difficult to apply to all yellowcake producers due to the cost involved.

it was building a nuclear reactor before Israel bombed the site in October 2007.

Successive DGs and their Secretariat staff have not only been aware of the increasing political sensitivity of special inspections, but have been conscious that a failed special inspection — either in terms of a refusal or of a failure by inspectors to find anything useful — would damage both the Agency and the chances of ever using such inspections. Often, they are not convinced that they have sufficient evidence or sufficiently credible evidence on which to proceed, and that a "fishing expedition" would not be countenanced.

These arguments have a circular character that needs to be broken. The Secretariat's growing use of intelligence information to provide leads about possible non-compliance may make it more confident that a special inspection is likely to succeed. In addition, supportive member states may establish useful precedents by volunteering to accept special inspections in cases where the Agency requires more information about their activities or facilities. Another way would be for the Agency to begin requesting a special inspection in the case of any unexpected event, where it knows such an inspection would be useful, although not strictly necessary, and where a refusal is unlikely. Given the extraordinary circumstances of the Fukushima event, a special inspection could have been requested of Japan to determine that safeguarded nuclear material remained where it was supposed to be, since the Agency clearly was not in a position to satisfy itself that "no diversion," accidental or not, had taken place. In view of the traumatic circumstances of the accident, subjecting the Japanese authorities to such a procedure would have been perceived as adding insult to injury. Nevertheless, this is an example of what might be considered in the future, in less trying situations.

John Carlson also notes that what are technically special inspections have been conducted informally by the Secretariat, without the Agency or the state concerned regarding them as such. He says that "while some may question the precedential value of such inspections, they clearly show the possibility of a non-contentious, cooperative approach to special inspections — as also demonstrated in the Romanian case" (Carlson, 2005: 2). In terms of optics, a special inspection can be portrayed as an effort to confirm a state's compliance, not to prove its guilt.

Support for the use of special inspections has been growing. Both the Secretariat and the BoG, many member states and all of the international disarmament commissions have expressed support for the full use of the Agency's "legal authorities." A current useful test case could possibly be Myanmar (GSN, 2011d), which may be more amenable to a special inspection now that its military regime seems to be moving the country in a more democratic, open and cooperative direction. Myanmar has been suspected of cooperating with North Korea on a nascent nuclear program. It presently has an old variety SQP, although the United States has pressured it to conclude an AP. In 2010, the Agency certified that Myanmar was among the states for which declared material remained in peaceful activities (IAEA, 2011z: 8). The Agency was, however, not in a position to certify that Myanmar had no undeclared nuclear activities. Reportedly, the Agency has asked Myanmar for additional access in order to clarify questions about such activities (Sen, 2011). Since this may amount to an informal special inspection it might be useful to declare it as such.

The potential need for special inspections has been attenuated somewhat by the inclusion of complementary access provisions in APs (IAEA 1997b: Articles 4–6). For states with APs in force, IAEA inspectors can request access to any place on a declared site and any other location in the state involved in the production of source material or where the state has indicated nuclear material is present. The purpose would be to assure the Agency of the absence of undeclared nuclear material and activities. Inspectors can also access any decommissioned facility or LOF to confirm its status. Finally, a little known provision allows inspectors to request access to any other location in the state, whether declared or not, for the purpose of resolving a question or inconsistency. The state is obliged to make "every reasonable effort" to provide such access.

This is a powerful new inspection tool that essentially permits the Agency, with 24 hours' notice, to seek access anywhere in a state, including in those cases where it suspects the state may be "cleaning up" evidence. By the end of 2010, some 1,241 complementary access inspections had been conducted in 42 states with APs in force or where an AP was otherwise being implemented.[31] Of course, states without APs — which include the states most widely suspected of nuclear weapon ambitions — are not subject to such complementary access (although they are subject to special inspections).

All states with CSAs are, meanwhile, subject to Agency access for the purpose of verifying facility design information. Access is to be provided to any location in a facility for this purpose. In conjunction with requiring states to provide early design information, the BoG has agreed that verification of design information is a continuing Agency right. Periodic design information verification is, therefore, a regular feature of safeguards (IAEA, 2006h: 40).

Finally, for those states with integrated safeguards, unannounced inspections are included as one of the available measures for most facilities. In certain circumstances these can increase both safeguards effectiveness — by improving detection capability — and efficiency — by requiring fewer inspections. As the Agency points out, historically such inspections have, in practice, been difficult to conduct due to administrative and technical obstacles. However, with computerized accounting systems and easier travel (including multiple entry visas for inspectors), unannounced inspections are increasingly feasible in cooperative states (IAEA, 2006h: 12).

The Agency is seeking to develop and implement more efficient safeguards approaches using new combinations of existing techniques and technologies, such as remote monitoring, unattended measurements and unannounced or short-notice inspections (IAEA,

31 Calculated by adding each year's numbers from 2006–2010 to the Agency's cumulative figure of 600 by 2005 (see www.iaea.org/OurWork/SV/Safeguards/es/es2010.html).

2011cc: 4). One application would be for verifying spent fuel transfers between their storage at reactor sites and longer-term storage sites, or to permanent disposition in deep geological repositories. This would help relieve what many states, including Canada, consider to be the over-intensive verification of such transfers using traditional means, such as on-site inspection and reporting.

The strengthened safeguards system still leaves the IAEA a long way from the "anytime, anywhere" verification envisaged, perhaps naively, in its statute.[32] There is still a possibility that undeclared facilities could go undetected, even with the AP in force in a potential proliferant state. A state that is bent on non-compliance will take active measures to conceal its activities, including disinformation and delaying tactics, such as those deployed by Iran and Iraq.[33] The inspection regime the Agency now operates is, however, a vast improvement on the previous one. It undoubtedly increases the level of uncertainty and risk that a potential, or actual, violator would have to factor into its decision-making processes, thereby increasing the costs involved in any attempt to cheat and increasing the deterrent effect of verification. The inspection system is also better integrated into other aspects of the IAEA's detection capabilities, which together, makes verification more powerful.

Detecting Weaponization and Military Dimensions

Arms controllers had argued for years about whether the IAEA could, within its mandate, use all verification tools possible to verify that a state party was not engaged in a nuclear weapons program, or whether the Agency was restricted to simply confirming that there had been no diversion of declared peaceful nuclear materials and facilities to weapons or unknown purposes. In any event, the IAEA did not have the necessary tools to verify anything beyond that until the 1990s, even if it had wanted to do so (states that did have the tools, such as satellite imagery and active intelligence services, also missed illicit activities in Iraq, Iran, Libya and North Korea).

In the cases of South Africa, Iran, Iraq and Libya, and in respect of the A.Q. Khan network, the Agency has come face to face with the weaponization issue. After South Africa had dismantled six weapons, the Agency was obliged to determine that it had actually done so. The IAEA's Iraq Action Team used personnel from NWS to understand and dismantle Iraq's nuclear weapon's program, but this was under a UN Security Council mandate, not one that flowed from IAEA safeguards. The Libyans received nuclear weapon blueprints from the A.Q. Khan network, which they handed over to the Agency, although they were immediately sealed on-site and remained in the custody of US personnel.

The Agency is now actively engaged in seeking to determine how far Iran might have gone in preparing to weaponize nuclear material. The Secretariat's November 2011 report to the BoG on Iran (IAEA, 2011p) provided an annex that listed "Possible military dimensions to Iran's nuclear programme," covering nuclear explosive development indicators, including: nuclear components for an explosive device; detonator development; initiation of high explosives and associated experiments; hydrodynamic experiments; modelling and calculations; experiments with a neutron initiator; preparations for conducting a nuclear test; integration of a putative warhead into a missile delivery vehicle; and investigation of a fusing, arming and firing system for a nuclear weapon. Clearly, the IAEA is moving into a completely new dimension, which raises significant issues, including for the conduct of nuclear safeguards (Carlson, 2006a).

The first issue is whether this falls within the Agency's mandate. Nowhere in the IAEA Statute does it state that the Agency deals with anything but nuclear material, and even then, only nuclear material it has been asked to safeguard. However, the NPT clearly accorded the Agency the role of verifying compliance by non-NWS with safeguards agreements pursuant to the treaty designed to verify compliance with Article II — the undertaking not to "manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices" (IAEA, 1970: Art. II).

A narrow interpretation of this could still mean that the Agency was only to concern itself with declared nuclear material that is diverted from safeguards to the manufacture of a nuclear device. Since there is quite a technological gap between diverting nuclear material and actually manufacturing a device, it would seem that the NPT itself does not ban the research, development and preparatory work that take place between these activities. As Jozef Golblat avers, the NPT does not explicitly prohibit research and development (2002: 102). However, as the individuals who led the American and Soviet negotiators that drafted Article II have pointed out, there was an "unchallenged view," advanced by the United States during the NPT negotiations that: "Facts indicating that the purpose of a particular activity was the acquisition of a nuclear explosive device would tend to show non-compliance. (Thus the construction of an experimental or prototype nuclear explosive device would be covered by the term 'manufacture' as would be the production of components which could only have relevance to a nuclear explosive device.)" (Bunn and Timerbaev, 1994). However, Acton and Newman note that even this is a surprisingly narrow view of what is involved in the acquisition of a nuclear weapon (2006: 13).

A more expansive and logical (or common sense) reading of the NPT is that the Agency was charged with verifying compliance with Article II in its entirety, especially as there is no other verification agency available. Moreover, in light of failures to detect major violations of the Treaty by Iraq, Iran, Libya and North Korea, only

32 Article XII.5 of the IAEA Statute gives the Agency the authority "To send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, who shall have access at all times to all places and data and to any person who by reason of occupation deals with materials, equipment, or facilities which are required by this Statute to be safeguarded, as necessary to account for source and special fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose…"

33 Iraq attempted this in its dealings with the IAEA Action Team, UNSCOM and UNMOVIC.

one of which involved diversion of fissile material from a purportedly peaceful program, but all of which involved moves towards building a nuclear device, it seems absurd that the IAEA would today ignore any evidence that an NNWS was engaged in weapons-related activity. This is perfectly illustrated by the case of Iran. The Agency has repeatedly concluded that it is able to "verify the non-diversion of declared material at the nuclear facilities and LOFs declared by Iran under its Safeguards Agreement," while at the same time being unable to "provide credible assurance about the absence of undeclared nuclear material and activities in Iran, and unable to conclude that all nuclear material in Iran is in peaceful activities" (IAEA, 2011p: 52). It would be absurd for the Agency to ignore the purpose that undeclared nuclear activities might be geared towards achieving.

One approach to resolving this uncertainty would be for the Secretariat to seek clarification of its rights and obligations as it previously did when the strengthened safeguards system was being considered. The risk in the Secretariat openly seeking such clarification from the Board or GC, or even worse, the UN Security Council, is that it would incite controversy and fail, making the situation muddier than before. In any case, the Agency is clearly proceeding on the assumption that it has such a right and responsibility. The constant expansion of IAEA prerogatives under the strengthened safeguards regime would also indicate a strong desire on the part of member states for the Agency to be involved in detecting undeclared activities. In international law, as in domestic law, practice and precedent count. To date, no IAEA member has sought to prevent the Agency from developing its weaponization detection capacities to deal with the specific case of Iran, except for Iran. In this case, it is better to let sleeping dogs lie.

A second major issue deriving from the weaponization question is that the IAEA is supposed to deal with the peaceful uses of nuclear energy and is not supposed to have expertise in nuclear weapons. There has always been a concern that the expertise required by the Agency to prevent nuclear weapons proliferation may paradoxically lead to the very problem the Agency is supposed to tackle. The question is: Where can and should the Agency draw the line in what is an alarmingly grey area? To date, it has been scrupulously discreet in using the expertise and knowledge of staff from nuclear weapon states whenever weaponization issues arose. This expertise and knowledge has been tightly held. As Mark Gwozdecky notes, the Agency takes seriously its solemn obligation under Article II of the NPT not to acquire information or to provide assistance in the manufacture of nuclear weapons.[34] Keeping nuclear weapons designs on hand at the IAEA would certainly be a breach of Article II. The Agency should be trusted to continue this tradition, with the proper procedures and "safeguards" in place and subject to periodic review.

A third issue concerns the type of expertise, capacities and rights that the Agency would need to fulfill a mission to detect weaponization activities, and how explicit these should be. Acton and Newman go into some detail about this in a study for the London-based VERTIC (Acton and Newman, 2006). The Agency is already scouring open-source literature, accessing satellite imagery, accepting intelligence information and, in general, seeking indicators of undeclared materials, facilities and activities, all of which may lead it to uncover some evidence of a weaponization effort. It already has the right to request special inspections and, under APs, complementary access. In openly pursuing Iran's weaponization activity, the Secretariat is presumably establishing the foundations of a more substantial and permanent expertise in such matters. It remains to be seen whether any member state would object to a specific unit being established to consolidate this for future use. The Secretariat's best plan in this case would be to quietly enhance its capabilities without seeking formal approval, a ploy it has used in other cases (for instance, in establishing units rather than divisions or departments, which require BoG approval).

Transparency and Openness

Concerns have been expressed about a lack of transparency and openness within the Agency on two grounds. First, internally it allows vital information about state compliance to be held too tightly within certain offices, thereby defeating the purpose of a holistic approach (ICNND, 2009: 91-92). Second, it constrains the ability of outside stakeholders, including even its member states, to learn about the Agency's activities, thereby constraining the Agency's attempts to garner greater interest and support.

There is an elusive optimal trade-off between confidentiality and transparency that organizations often find difficult to find and sustain. In the Agency's case, it needs to be careful to preserve the confidentiality of information provided by states, in particular, information that may assist a nuclear proliferator or intelligence data derived from sensitive sources. The 1995 OTA report opines that, while the Agency has earned the reputation of being able to keep confidential information "closely held within its ranks," the practice of protecting "safeguards confidential" information "appears to extend into areas and types of information that may, in fact, offer benefits in creased public confidence in the safeguards system if they were made available" (OTA, 1995: 17). The ICNND, almost 15 years later recommended "greater transparency in the IAEA's internal processes, how judgements are reached and decisions taken in the safeguards area especially and…a new approach to information sharing, in which states and the Agency work together as partners" (ICNND, 2009: 91-92).

Safeguards reports on individual states are not typically made public. Currently, however, all of the special safeguards reports to the Board on non-compliance cases, such as Iran and North Korea, are released, but only because they were consistently and systematically leaked by one or more member states. As a result, the BoG began to take decisions at the end of each meeting to authorize the Public Information Division to make the reports public, even though the

34 Personal communication with the author.

media and some non-governmental organizations had them from the moment of issuance.

The annual SIRs, which summarize safeguards implementation for the previous year, are unavailable to the public despite a substantial effort to protect the identities of countries and facilities (although they are sometimes named). SIRs present both an overall assessment of compliance with safeguards and a report on how well the IAEA has met its safeguards goals, including timeliness and problems it has encountered with containment, surveillance and other equipment. The Agency could make more information available, with appropriate context, to permit all member states and all other stakeholders, including civil society and industry, to "verify" compliance and the Agency's performance. If used correctly, with the proper explanatory information, the SIR should have the role of "naming and shaming." There are various ways to approach this, but one would be for more public transparency on the general safeguards performance of each state, combined with a confidential "management letter" to each state outlining how it might improve its safeguards performance.[35]

Roger Howsley, Director of WINS, has called the SIRs "data rich and information poor" (2011). Issues with implementation, such as late reporting, poor data and inspection problems, are frequently glossed over, as it is not in the Secretariat's interest to report on these issues. Much of the detailed data could be put into a classified annex, while more interpretive and contextual information could be included in the Report. In June 2011, the BoG congratulated the Secretariat for improving the transparency of the Report (although not to outsiders) (IAEA, 2011cc: 9), which was accomplished by including additional details on the results of safeguards activities. More state-specific information was provided, including the number of facilities and LOFs under safeguards, the safeguards activities conducted, the cost of safeguards implementation and the results of safeguards activities.

More context is now given about the non-achievement of safeguards goals by the Secretariat, after the 2010 SIR had implied that Canada and the United Kingdom were in non-compliance (both countries subsequently complained to the Secretariat). Howsley suggests that SIRs be further reformed and publicly released on the grounds that "greater transparency and accountability may provide the oxygen for improvement." He argues that currently, the most sensitive comments in the SIR relate to states that are in serious violation of their safeguards agreements — Iran and North Korea — and that information is already unrestricted, published and made available online. Thus, it is hard to know why the rest of the SIR should be restricted, unless it is to save the Agency and certain member states from embarrassment.

Subsidiary Arrangements made by the IAEA with states are also confidential. As Scheinman notes, the net effect is not only confidentiality for the state being safeguarded, but "to make it difficult for others to evaluate safeguards effectiveness" (Scheinman, 1987: 135). In early 2012, VERTIC revealed that deep inside the Agency's "sprawling website" it had found publicly available documents designed to help states implement their safeguards obligations, in particular, how safeguards inspections are supposed to be conducted (Persbo, 2012). These details about Subsidiary Arrangements are a welcome, although perhaps inadvertent, increase in public transparency.

The Secretariat would do well to conduct a comprehensive in-house study of the confidentiality/transparency issue. Roger Howsley proposes that the IAEA consider adopting ICAO's "Comprehensive Systems Approach" to transparency (2011). If the Agency expects stronger stakeholder support for its safeguards role, it needs to more openly communicate with its member states, the media, civil society, the nuclear industry and other organizations involved in nuclear governance.

Use of Intelligence Information

The IAEA has increasingly come to rely on secret intelligence information from member states to provide it with leads on proliferant activity or to corroborate other information. To date, it has done so in the cases of Iran, Iraq, North Korea, Syria and Libya. The Agency needs to walk a fine line in accepting and handling such information. It is aware that it must seek to rely on more than one source, must conduct its own due diligence on the information and should seek corroborative evidence elsewhere. In its November 2011 report on Iran's alleged weaponization activities, the Agency went out of its way to explain that it had examined all information carefully and critically, grilled the United States (without naming it) on the critical information it had provided and that 10 countries (not just the United States) had provided it with information (IAEA 2011p: 3). The Agency is also acutely conscious that it must protect the confidentiality of the intelligence information it receives. Thus far, it has been remarkably successful in doing so, notwithstanding an overall record of guarding confidential information that Mark Gwozdecky describes as "checkered."[36] As a supra-national body, the IAEA has no means of conducting the normal security clearances on its personnel, because national authorities are unlikely to provide useful information on their citizens. Instead, it seeks to keep the information accessible only to a tight circle, sometimes only the DG and his trusted confidantes.

The IAEA is clearly not an intelligence agency in the sense of seeking out, by fair means and foul, secret information on its member states. Given the suspicions on the part of the non-aligned states about any multilateral body acquiring such a capacity (seen most sharply in their opposition to UN peacekeeping operations doing so), the IAEA naturally seeks to rebut this suggestion. Apart from the small amount of secret intelligence information received from member states relating to certain non-compliance cases, all of the information received by the Agency is either voluntarily provided

35 I am indebted to Joe Pilat for this idea.

36 Personal communication with the author.

to it by the state concerned, sometimes classified as "safeguards confidential," or is obtained from open sources.

While recognizing that even well-endowed governments sometimes have difficulty in preserving secrecy, the Agency should continue to strengthen its procedures to ensure that truly confidential information provided by states is kept that way (notwithstanding the need for the Agency to be generally more transparent and open in its operations). It should also continue to emphasize, at every opportunity, that it is not an intelligence agency, but an agency that uses intelligence information in fulfilling its important role in enhancing international security.

An Additional Protocol Plus?

The question has been raised in several quarters, notably by the ICNND, about whether there should be an "Additional Protocol Plus" (ICNND, 2009: 85). This would include updating the AP technical annexes to include relevant dual-use items; shortening the notification periods for inspections; and seeking the right to interview specific individuals. Given the opposition in some quarters to the existing AP, it is probably politically unwise to label further improvements an Additional Protocol Plus, implying that some new legal document is required. The better course for the Secretariat would be to quietly implement changes, as it has done on many occasions. The right to interview individuals is, arguably, already provided for in the AP (and the Statute). DG Amano has specifically requested this in the case of Iran (as well as publishing the results of an interview with a Russian who had assisted the Iranian nuclear program as part of the Agency's November 2011 report on Iran) (IAEA, 2011p: Annex: 9). In regard to the Iran case, Amano has told *The Wall Street Journal* that: "We have listed the elements that need to be addressed. We would like to have access to people, documents, information and locations" (GSN, 2011a). It would be useful for the BoG to specifically affirm the right of the Agency to request interviews under both CSAs and APs, in the same way it has reaffirmed the right of the Agency to request special inspections. Over the longer term, another possible innovation, proposed by SAGSI, is the use of infrequent intensive inspections, which builds on the advantages of unpredictability in verification.

OTHER IAEA NON-PROLIFERATION ACTIVITIES

In addition to the activities to detect, prevent and combat nuclear smuggling outlined in the nuclear security section of this report, the Agency is also involved, among other things, in the following relevant non-proliferation activities.

Assurances of Supply and the Multilateralization of the Fuel Cycle

Efforts to expand global governance over the years to cover all aspects of the nuclear fuel cycle, including those involving the Agency, have largely come to naught (SIPRI, 1980). Although not an IAEA initiative, the aim of the International Fuel Cycle Evaluation (INFCE) launched by President Jimmy Carter in 1977, was to identify "proliferation resistant" arrangements that would restore confidence that civilian nuclear activity would not assist military programs. The INFCE was a "massive operation" (Fischer, 1997: 100) involving 66 countries in 133 meetings held in Vienna from November 1978 to February 1980. The IAEA provided a great deal of administrative and technical support, but it was, essentially, an American project.[37] As David Fischer points out, it was overtaken by events, including a rapid decline in enthusiasm for nuclear energy, a shortage of uranium, and rise in prices and the unlikely prospects of fast breeder reactors becoming a reality in the near future (1997: 100).

Attempts were subsequently made to pursue some of the INFCE's ideas, including: international storage of plutonium to ensure against its misuse; cooperation in the long-term disposition of spent fuel; and long-term assurances of supply. Discussions took place over the course of five years in an IAEA expert group on an International Plutonium Storage, established in 1978, on a scheme that would, like a fuel bank, partly fulfill one of the original ideas of Atoms for Peace embedded in Article XII.A.5 of the IAEA Statute. Disagreements resulted in a final report to the BoG in 1982 (IAEA, 1982) that set out three alternative schemes of "varying degrees of rigour" (Scheinman 1987: 287). The BoG took note of the report in 1983 and then did nothing until 1992, when new discussions were held among the largest plutonium-holding states (the five nuclear weapon states plus Belgium, Germany, Italy and Switzerland). An IAEA group was convened to study the issue. However, when the participants decided on confidential negotiations among themselves to avoid the complications of an official multilateral forum, DG Blix decided the Agency could not chair such a group. The outcome was Guidelines for the Management of Plutonium agreed by the participants and communicated to the Agency, along with declarations of their holdings (although not all plutonium-holding countries participate) (IAEA, 2004). The Guidelines were published by the IAEA in March 1998, along with subsequent declarations, and are now available on the IAEA website, offering increased transparency at least in this area.[38]

In 1980, the BoG sought further movement by establishing the Committee on Assurances of Supply (CAS), to seek to establish "procedures in international nuclear commerce that would reduce uncertainties in nuclear supply without compromising nonproliferation objectives" (Scheinman, 1987: 111). It was unable to "reconcile the irreconcilable," as Scheinman puts it (Scheinman, 1987: 295) — namely, the desire of developing states for unfettered access to nuclear materials and technology, and the desire of the West to strengthen nuclear non-proliferation. The CAS expired in 1987. That same year, the Conference for the Promotion of International Co-operation in the Peaceful Uses of Nuclear Energy, which traced its

37 It was, for instance, chaired by Professor Abram Chayes of Harvard University.

38 For further details see Findlay (2010c: 51-52) and ISIS (2005).

origins to the INFCE, foundered over nuclear disarmament (Fischer, 1997: 102).

In June 2004, DG ElBaradei breathed new life into the issue by appointing an international expert group to consider possible multilateral approaches to the front and back ends of the nuclear fuel cycle, which reported in February 2005 (IAEA, 2005b). In September 2006, a Special Event on Assurances of Supply and Assurances of Non-Proliferation was held during the GC, after which the DG undertook to prepare a report for the BoG on options for nuclear fuel supply assurances (IAEA, 2007d). All of this activity stimulated renewed discussion and the submission of ideas from several member states (as well as academic and non-governmental sources) (Yudin, 2009). Some proposals restrict themselves specifically to providing guaranteed nuclear fuel, while others veer towards multilateralizing parts of the fuel cycle.

This ferment led directly to the establishment of the Low-Enriched Uranium Fuel Bank, a version of the Nuclear Fuel Bank first envisaged when the Statute was negotiated. Instead of having the range of nuclear materials originally envisaged, the bank only contains LEU, in view of the obvious non-proliferation lessons learned since the 1950s. The initiative was proposed by the non-governmental Nuclear Threat Initiative (NTI) in September 2006, which committed US$50 million to the IAEA to help it establish a stockpile of LEU to provide fuel assurances for non-proliferation compliant states. A condition was that IAEA member states had to commit an additional US$100 million, an amount raised by March 2009 with contributions from the European Union, the United Arab Emirates, Kuwait, Norway and the United States.[39] After initially being rejected by the BoG, the proposal was finally accepted in February 2010. An IAEA Nuclear Fuel Bank team, funded through voluntary contributions, was set up in the Department of Nuclear Energy to handle the scheme.

After Kazakhstan made the only offer to host the physical repository, an IAEA technical mission was dispatched there in August 2011. It identified the Ulba Metallurgical Plant in Ust-Kamenogorsk (Oksemen) as the best suited of the two sites offered (IAEA, 2011f). Negotiations are continuing with Kazakhstan before the matter is finalized. The IAEA will have cameras at the site, which would occupy one-half of a building, for continuous monitoring, but will not station any personnel there permanently. It remains to be seen how successful the venture will be. Developing states were surprisingly lukewarm about the idea, viewing it as impinging on their Article IV rights under the NPT and forcing a contentious vote on the idea in the BoG.

In 2006, Russia proposed creating an LEU Guaranteed Reserve that would be available at the request of the IAEA for its member states that find themselves, for political reasons, unable to procure LEU from the open market (IAEA, 2011g). After the BoG approved the initiative in November 2009, the IAEA and Russia signed an agreement on March 29, 2010, to establish the reserve (120 tons of LEU enriched up to 4.95 percent) at the International Uranium Enrichment Centre's storage facility in the city of Angarsk, Russia. It was inaugurated in December 2010 following the first IAEA inspection, and since entry into force of the agreement on February 3, 2011, the reserve has been available for IAEA member states. It is not known whether any have yet taken advantage of it. Again, the developing countries forced a vote in the BoG on this proposal.

It is unclear whether the IAEA will be in a position to further advance any of the various other ideas on assurances of supply and multilateralization of the fuel cycle in the near future. Presumably, much will depend on the success or otherwise of the two existing reserves. Yury Yudin makes the point that any multilateral mechanism must involve the IAEA, and must be in accordance with the IAEA Statute (2010: 11–15). All of the existing proposals do so, to a greater or lesser extent, and one proposal from Japan is even called the IAEA Standby Arrangement. The establishment of more complicated or radical arrangements is likely to occur only gradually, giving the IAEA enough time to assess its precise involvement. As Yudin warns, these should not be allowed to detract from the Agency's other priorities (2010: 15).

Middle East Nuclear Weapon-Free Zone

One of the perennial issues that the BoG and GC have had to deal with is the question of Israel's nuclear weapon capability. Although Israel is not party to the NPT, it is a member of the IAEA, as are the two other NPT "holdouts," India and Pakistan. Israel has, however, been a particular target of the radical non-aligned, including the Arab and Islamic members of the Agency. While a campaign to deprive the Israeli delegation of its credentials narrowly succeeded in 1982, it brought down the wrath of the United States, its withdrawal from Agency participation and a temporary cutting off of its sizeable financial and other contributions. The non-aligned have never tried this again, but they have continuously brought up the issue of Israel's nuclear activities, campaigning to have them declared and put under IAEA safeguards, presumably thereby involving a process of nuclear disarmament and accession to the NPT. They have also called for a Middle East NWFZ or WMD-free zone that also bans chemical and biological weapons.

The fact that this campaign is led by states that do not themselves have spotless non-proliferation records, came late to the NPT and/or have not acquired APs (among them Egypt, Syria and Iran) seems not to deter their supporters. At both NPT Review Conferences and the IAEA, resolutions are ritually proposed, usually by Egypt, for commencing negotiations on such a zone. In the past, NPT Review Conferences have foundered, or almost foundered, over the issue, but at the last conference in 2010 there was some movement on the issue that helped avoid another deadlocked review conference. It was agreed that there would be a conference on a Middle East NWFZ held in 2012. Israel indicated that it would consider attending and Finland has offered to host it.

39 From "NTI in Action: Creating an International Nuclear Fuel Bank," NTI. Available at: www.nti.org/b_aboutnti/b7_fuel_bank.html.

The IAEA's role dates from 2000 when a GC resolution called for convening such an event. The Agency convened a preliminary meeting in Vienna in November 2011, to begin discussions around the theme of the lessons to be learned from other NWFZs, of which there are now five. The conference did little more than provide a platform for an exchange of views and information, but it was relatively civilized (Iran boycotted the conference due to the recent round of sanctions imposed on it). The IAEA role was confined to providing the venue and conference services, along with moral support from the DG. It is clearly in the Agency's interests to be as helpful as possible, since the issue has the capacity to disrupt the work of the BoG and GC, sour the political atmosphere and seriously distract the Agency from other pressing priorities.

A looming potential disaster for the Agency is the current campaign by Palestine to achieve recognition in various UN and UN-related bodies, over frustration at being denied such status in the UN General Assembly. In October 2011, the Palestinians succeeded in being admitted to UNESCO, resulting in the United States, Israel and some other states withdrawing their funding from the organization (Lynch, 2011). The IAEA has been mentioned as a potential future target of such action, given its prominence in international security matters. If the UNESCO precedent were to be followed in the BoG, there could be a repeat of the 1982 episode over Israeli credentials.[40] At a minimum, the Europeans would need to be unified in opposition (unlike in the UNESCO case) and key abstainers need to vote against it.

If Palestine were admitted to IAEA membership, crucial US funding for the Agency would be threatened, as the US administration would be bound by a Congressional act requiring funding to cease. Withdrawal of US funding for any length of time would be catastrophic for the IAEA's finances and, hence, its operations. One can also imagine that if Israel carries out its threat to attack Iran's nuclear facilities, the Middle East issue could have an even more calamitous effect on the Agency (the 1982 Arab campaign against Israel at the Agency was emboldened by Israel's 1981 attack on the Osirak reactor in Iraq).

In the case of the Middle East NWFZ issue, the IAEA is being subjected to forces far beyond its ability to control or even significantly influence. Ultimately, the DG and his Secretariat is powerless to make a difference beyond a willingness to convene meetings and to provide whatever verification arrangements might be required, if there was an agreement on a zone. Real progress on the zone, ultimately, depends on currently unthinkable progress in the Middle East peace process.

NON-COMPLIANCE WITH SAFEGUARDS

Related to the efficacy of safeguards is the question of what to do when non-compliance is discovered. Observers, over the years, have argued that the Agency should stick to technical judgments and not become involved in political considerations. In the 2009 ICNND report, this line was echoed, undoubtedly with the Iran case in mind:

> It is important, if [its] credibility is to be maintained, that the IAEA confine itself essentially to technical criteria, applying them with consistency and credibility, and leaving the political consequences for the Security Council to determine. Issues of standard of proof become relevant here, and the IAEA has not helped itself by in practice setting the bar higher than its own standard safeguards agreements, which provide, for example, that a state may be found in non-compliance if the Agency is not able to verify that there have been *no* diversions" (ICNND, 2009: 87).

This is unpersuasive. First, the Agency is indisputably tasked by its member states with seeking undeclared materials, facilities and activities, not just those that have been diverted from peaceful uses. Second, while it is clear that the Secretariat should only be involved in making technical judgments, it is naïve to presume that the DG and the BoG should not. Often, the question of timing will be an intensely political issue, which the DG and BoG would be irresponsible in ignoring. The ICCND report notes that: "A basic problem is that a finding of non-compliance almost inevitably involves both technical and political dimensions." Bearing in mind these political facts of life, there are certain steps that could be taken to improve the future handling of non-compliance cases.

First, it is essential that the Board and, if necessary, the IAEA membership as a whole, clarify the meaning of "non-compliance" and whether all breaches of a safeguards agreement, no matter how long ago they occurred or how relatively "minor" they are considered should be, should be declared to be "non-compliance." There is an argument that both South Korea and Egypt should have been found in non-compliance for their safeguards breaches, discovered in 2004 and 2005 respectively (Carlson, 2009a).[41]

Second, the Board should formally confirm that non-cooperation with the IAEA in its attempts to resolve a non-compliance issue should itself constitute non-compliance (as it did in the case of North Korean non-cooperation). The Board should make it clear that it is the responsibility of the state to prove its compliance to the Agency, rather than the other way around, as has traditionally been the case.

Third, and more broadly still, there have been proposals for dealing with withdrawal from the NPT and by implication its comprehensive safeguards agreement, by a state that is in non-compliance with its safeguards obligations (Goldschmidt, 2010). One idea is for a declaration by the NPT states parties that a state withdrawing from the treaty is not entitled to use nuclear materials, equipment and technology it obtained while a party to the treaty, and must return

40 As with UNESCO, IAEA membership requires a recommendation by the Board, with a vote to follow in the GC. However, it is not clear whether the GC vote needs to be two-thirds, as in the UNESCO case. It could, however, be made to require a two-thirds majority by a simple majority vote. BoG votes generally require a simple majority, but also could be made to be two-thirds by a simple majority vote.

41 Undersecretary of State for Arms Control and International Security John Bolton told reporters that the United States would not "apply a double standard" to South Korea." See www.armscontrol.org/act/2004_10/IAEA_Seoul_Nuclear_Program.

these forthwith. This would include those obtained from the IAEA. A second idea, from the ICNND, is a protocol to CSAs extending safeguards in perpetuity, as in the case of the IAEA-Albania safeguards agreement (ICNND, 2009: 89). A third proposal is for states to make it a condition of supply that, in the event of withdrawal from the NPT, safeguards should continue with respect to nuclear material and equipment provided, as well as on any material produced by using it. These suggestions are mostly beyond the power of the IAEA to effect, at least by itself, and rely on member states taking the initiative.

All of the ideas have merit, although a non-compliant state withdrawing from the NPT will already have crossed such a normative and legal barrier that it is unlikely to be swayed by such legal niceties, perhaps with the exception of the Security Council taking enforcement action under Chapter VII of the UN Charter.

Secretariat Involvement in Non-compliance Cases

As discussed in the section above on governance and leadership, the handling of non-compliance cases by the Agency is both a political and technical process, which tends to quickly become politicized. As also indicated above the DG, as the head of the Secretariat and the public face of the Agency, also tends to be drawn into the controversy surrounding non-compliance cases, if not the politics of them. Moreover, it is impossible to control for the personal quirks of DGs that may exacerbate this tendency.

Notwithstanding this, efforts can and should be made to protect the Secretariat (below the level of the DG) from accusations of bias and/politicization and ensure a coherent, comprehensive and replicable approach to non-compliance cases. This is probably what the ICNND meant when it called for the Agency to stick to technical issues and not venture into political judgments.[42] It is important to understand how the Secretariat arrives at its conclusions about compliance and how this is reported to the BoG. This has been described in the discussion of preparation of State Evaluation Reports on page 68.

When an "anomaly" is detected by inspections, or these days by any other validated source of information, a report will be prepared for the Director of Safeguards, who, depending on the seriousness of the case, may deal directly with state authorities in an attempt at its resolution. If the issue is more serious or if the initial approach to the state, starting with the SSAC if one exists, does not work, the DG will be informed. The DG may then communicate with the nuclear authorities in the state concerned at the highest level. If the result is unsatisfactory and the issue not resolved, a report will be prepared for the BoG. It is at this point that the issue of politics starts to intrude, as the report is usually made public. Great care must, therefore, be taken to ensure that the contents are accurate, the legalities are squared off and the tone is appropriate. According to the IAEA Statute, the document is to be a report by the Safeguards Department,[43] but over time, it has become the DG's report, raising its import even further: in popular parlance and expectation the DG is ultimately responsible for it. However, it is the Safeguards Department, not the DG, that briefs the BoG on the report, in so-called technical briefings prior to formal BoG meetings, on the grounds that they are the experts who are best placed to do so. ElBaradei met with the briefers beforehand, to get the "party line" and key findings right, but did not demand to vet the briefing itself.

Each report sets out the history of the case, the analysis of the facts and the steps required to resolve the case. The drafting team comprises representative from the Department of Legal Affairs, the DG's office, including external relations experts, and the Department of Safeguards. While Safeguards is, therefore, in a minority on the team, it almost always chairs it. Membership of the group depends on the needs of each case, but the DG always signs off on it.

Hans Blix and Mohamed ElBaradei both took a personal hand in fine-tuning each report. ElBaradei records how the process worked under his tenure, in close collaboration with the Director of the Safeguards Department, Olli Heinonen: "As in any institution there were differences of view among the many people providing input on complex issues, including between the lawyers and the technical people. My reports to the Board on Iran customarily went through ten to fifteen drafts, with painstaking efforts to get the facts straight and ensure objectivity in our assessments. But in each case Olli and I agreed on the final report before its issuance" (ElBaradei, 2011: 283). One of the criticisms of ElBaradei's tenure, though, was that the external relations office, EXPO, had too much of a hand in shaping the reports, reportedly attenuating the starkness of the technical findings with considerations for the political impact on the accused state, its allies and on the Agency itself. It is not clear, however, how the Secretariat could operate in any other way. Compliance reports cannot simply be written by technical staff without regard to legal and political considerations.

One difficulty with this process is that it may produce a different type of report each time, for each different non-compliance case. While it is axiomatic that each case is different, politically it is important that states see that they are all treated on an equal, non-discriminatory basis. Hence, non-compliance reports should use similar, agreed language and encompass the same considerations. In 2007, in order to at least partly achieve this, the Secretariat decided to use the following terms in its reports:[44]

- "consistent" with a state's obligations, meaning the findings were consistent with the state's declarations;
- "not inconsistent," meaning there were gaps in knowledge, but not something that was too alarming;

42 Protecting the Secretariat from bias would not be possible if the Agency enters too far into the intelligence gathering and interpretation game.

43 "The inspectors shall report any non-compliance to the Director General who shall thereupon transmit the report to the Board of Governors" (IAEA Statute: Art. XII.C).

44 Personal communication with Olli Heinonen, former DDG for safeguards, at Harvard University, May 1, 2012.

- "inconsistent," meaning that there was some activity that was not consistent with the state's safeguards declarations obligations;
- "impossible" to determine; and
- "inconclusive."

With regard to the interpretation of environmental sampling analysis, the Secretariat has started to use the terms "highly likely," "likely," "less likely" and "impossible." Examples of this are in the Agency's statement in 2007 concerning contamination of Iranian enrichment sites by HEU,[45] attributed to Pakistan, and a statement in 2009 on contamination at the alleged reactor site at Al Kibar in Syria.[46]

This is useful in bringing consistency to the Agency reports, but consideration should also be given to rating the reliability of the information provided, in the way that US intelligence agencies have done since the Iraq WMD controversy. The National Intelligence Estimate now uses terms such as "high confidence," "medium confidence," and "low confidence" to provide more nuance to its judgments.[47] Such terminology will not necessarily obviate the need for fine-tuned judgment on the part of the Secretariat and the DG, but it would at least provide some basis of comparison between reports. There is some information the Agency cannot release, as it has not been corroborated. There will also be occasions when the Agency will not release certain information lest it permit the state under investigation to take action to hide or destroy evidence.

One of the complaints made about the DGs' reports is that they do not necessarily follow a pattern that is easily interpreted in sequential reports. When reports on a particular non-compliance case start to accumulate and expand in size, it is difficult for member states beyond the most sophisticated (as well as other stakeholders such as civil society) to keep track of unfolding developments. In the case of Iran, issues have dropped in and out (such as the issue of targets in the Iran case), whether they have been resolved or not. Occasionally, the reports have annexes attached that set out the issues to be resolved or are already resolved. This should become the norm and be kept updated. In addition, the reports should be made as self-contained as possible: otherwise, it is too difficult to trace back the chain of events and conclusions. Even issues where no progress has been made should be mentioned each time, especially since a lack of cooperation can be an insidious form of non-compliance, as Iran has demonstrated. Pressure should be kept up on non-compliant states, with regular public statements issued at the same time that reports are sent to the BoG. To ensure the conformity of the tone and format of future reports, the Secretariat could internally produce a "template" to guide standardization of structure, layout and terminology of non-compliance reports to Board.

DG Amano seems to be adopting some of these ideas. In the case of Syria, the DG recently released a report, even though no progress had been made since the previous one, apart from a late offer by Syria to engage in another round of dialogue (IAEA, 2011q). A report was also made to the BoG in 2011 on North Korea, even though the Agency no longer has access to its territory and it has declared its withdrawal from the NPT and withdrawn from Agency membership. The report on North Korea drew on non-Agency information from an individual, Stanford University Professor Siegfried Hecker, who had recently visited North Korea, setting a precedent for the use of this sort of information (IAEA, 2011e).

FUTURE SAFEGUARDS CHALLENGES

If the much-heralded nuclear energy revival ever comes to fruition, increased numbers of research and power reactors, additional nuclear trade and transport and moves by more states to acquire the full nuclear fuel cycle will require increased IAEA safeguards capacity and spending (Findlay, 2010a). In respect of existing types of facilities, this will simply require more Agency resources and personnel. With regard to new types of reactors and facilities, it will require new safeguards approaches. The Agency has already been encouraging plant designers to consider "safeguards by design" and in 2010, interacted with Canada, Finland and Sweden on these issues (IAEA, 2011cc: 5). The Agency is also preparing for safeguarding new types of non-reactor facilities such as geological repositories for spent fuel and nuclear waste, pyro-processing plants (currently under consideration by South Korea) and laser enrichment facilities (IAEA, 2011f: 5).

It may also awaken a "sleeper" issue that has long exercised the sharpest critics of safeguards: the fact that the current system cannot provide sufficient timely warning of non-diversion of fissionable material from bulk-handling facilities, such as those involved in uranium enrichment, plutonium reprocessing and fuel fabrication (discussed above). If a nuclear energy revival permits increasing numbers of NNWS to acquire such facilities, the safeguards system risks losing its credibility. Through its International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO), and in cooperation with the NEA's GIF, the Agency is helping assess the proliferation resistance of different nuclear energy systems. Following the success of the INPROF Collaborative Project on Proliferation Resistance: Acquisition/Diversion Pathways Analysis, which concluded in 2010, a new project on Proliferation Resistance and Safeguardability Assessment Tools — or PROSA — was launched by INPRO in 2012 to develop a coordinated set of methodologies using both the INPRO and GIF experiences (IAEA, 2012b).

Proposals for fuel banks, regional or multilateral enrichment facilities and the phasing out of the use of plutonium for civilian purposes, are widely deemed to be appropriate means for dealing with the proliferation implications of these developments, but all of these imply more powerful nuclear safeguards tools beyond even today's strengthened system. Faced with such challenges, the

45 See IAEA (2007g).

46 See IAEA (2011ee).

47 Office of the Director of National Intelligence (2007).

future evolution of nuclear safeguards lies in the realization by the international community that this form of verification is a security bargain that deserves openness, hard-headed scrutiny, commitment, finances and resources commensurate with its significance for international security.

INVOLVEMENT IN NUCLEAR DISARMAMENT

Although the IAEA is not specifically mandated to be involved in verifying nuclear disarmament, as previously mentioned, its Statute permits it to be charged with applying safeguards to fissionable material that results from such a process. Hence, the NWS could give the IAEA such a role as they gradually draw down their stockpiles of nuclear weapons. Such involvement by the Agency may alleviate some of the frustration expressed by the NNWS about being the constant target of IAEA verification while the NWS remain relatively untouched.

Prior to this occurring on a significant scale, there is the possibility that the Agency will be mandated to act as the verification agency for an FMCT, which would ban the further production of fissionable material for weapons purposes. Currently, that treaty is on the agenda of the Conference on Disarmament, but consensus has not been achieved on commencing negotiations. Over the years, a great deal of preparatory work has been done on how such a treaty might be verified and the IAEA has often been identified, including by former DG ElBaradei (Hibbs and Persbo, 2009: 13) as the most likely body to do so, especially given the expense and effort that would be involved in creating a new agency. In 1995, the Agency itself produced a study outlining four verification options for an FMCT that it presented to a workshop in Canada (Canada, 1995). In 2006 the Agency gave a presentation to the CD on the subject (Canada, 2006). John Carlson argues that, at the very least, it would make sense to base FMCT verification on the IAEA safeguards system, although the FMCT negotiating parties may decide on executive and decision-making arrangements that are separate from the IAEA (Carlson, 2009b).

One way to begin to prepare the Agency for involvement in both the FMCT and future nuclear disarmament verification activity is for the NWS to phase in the application of safeguards under the Voluntary Offer Agreements on two types of facilities: new commercial fuel cycle plants, and closed and decommissioned fuel cycle facilities.[48] This would reduce the technical and practical barriers to an FMCT and disarmament over time, and give the IAEA invaluable experience in the process. It would also create, in the case of the United States, a domestic demand for the services of the Next Generation Safeguards Initiative (NGSI) and the US Program of Technical Assistance to the IAEA, which may in turn further drive innovation that will benefit the Agency and its safeguard system (there is currently limited domestic demand, because the vast majority of US nuclear facilities are not under safeguards). It would also help force an early decision on how funding for such endeavors is to be resolved.

In 1996, the Trilateral Initiative was launched by the United States, Russia and the IAEA to establish a prototype verification system for ensuring that weapon origin and other fissile materials "released from defence programs" were irreversibly removed from any military purpose. By 2000, progress had been made in the development of technical approaches, including information barrier technology, to the verification of classified material, and in the negotiation of a new related Model Verification Agreement. That initiative petered out, in part due to financing issues, but also due to continuing difficulties over how to ensure verification without revealing sensitive information, including to the IAEA, about weapons-grade nuclear materials.

Currently, the Agency is participating in a project to help implement the 2000 US-Russia Plutonium Management and Disposition Agreement (amended in April 2010). This would not involve classified forms of the material. According to the agreement, each party must dispose of at least 34 tons of weapons-grade plutonium, enough for 17,000 nuclear weapons, either by immobilization or burning as MOX fuel. The three parties are currently working out the complex verification procedures required in order for a legally binding verification agreement to be concluded (IAEA, 2010a). This will be invaluable experience for the Agency's future involvement in nuclear disarmament verification. The Norway-UK-VERTIC exercise to investigate means of involving NNWS involvement in helping verify nuclear disarmament, is also relevant to future IAEA involvement (Norway, 2010).

Perkovich and Acton argue that an evolutionary approach to nuclear safeguards (which is ineluctably happening anyway) is one way for the IAEA to prepare for involvement in nuclear disarmament verification (2008: 73). One step would be to move the starting point for safeguards back towards the front-end of the nuclear fuel cycle by including yellowcake (refined uranium ore). In a disarmed world, nuclear safeguards will have to be vastly more intrusive and capable than they are currently, especially in respect of undeclared facilities and materials. The two authors suggest that states with nuclear-powered submarines should begin examining how the naval nuclear fuel cycle might be put under Agency safeguards, since an exemption for submarines would not be sustainable in a nuclear weapon-free world (Perkovich and Acton, 2008: 81).

Whether the Agency could be involved more directly in verifying the compliance of nuclear weapon states with a nuclear disarmament regime, beyond safeguarding nuclear material, is questionable. When Hans Blix offered Agency assistance in verifying compliance with the 1987 Intermediate-range Nuclear Forces Agreement, he was politely rebuffed. At the time, the Agency lacked expertise in missile and warhead technology — and it still does. The danger of the Agency coming into contact with weapons designs has already been mentioned. A further risk is being caught up in a compliance dispute between one or more of the P5 members of the UN Security Council.

48 I am indebted to John Phillips of the Pacific Northwest National Laboratory for these ideas.

CONCLUSIONS

There currently is a great deal of ferment in IAEA Safeguards. The new Director of the Safeguards Department, Herman Nackaerts, appears determined to implement new safeguards approaches, including furthering the cultural change process that has been underway for some time. Armed with the new Strategic Plan, the Department should be well placed to take the broader, strategic view of proliferation threats that has long been expected of it. While safeguards is always in need of further resources, the most critical area at present would appear to be in completing the facilities at Seibersdorf. Meanwhile, the implementation of IT reforms, better recruitment, training and management of inspectors and transparency reforms should be pursued apace.

RECOMMENDATIONS

- The Secretariat should fully implement the Safeguards Department Strategic Plan.
- The Secretariat should continue to develop its state-level approach, including by vigorously pursuing cultural change in its inspectorate and throughout the Safeguards Department.
- The Secretariat should internally produce a "template" to guide standardization of structure, layout and terminology of non-compliance reports to Board.
- Special Inspections should be prepared, tested and implemented by the Secretariat as the half-way measure between routine and challenge inspections in cases where there are unusual circumstances, falling short of a suspicion of non-compliance (Myanmar may be a good first test); states in full compliance should also offer to host a special inspection to allow the Agency to perfect its techniques.
- Further research and development should continue be undertaken and encouraged by the IAEA, with the assistance of member states, into new, promising verification techniques, particularly for the detection of undeclared facilities and materials.
- Moves should continue to be made to make the AP the "gold standard" of nuclear safeguards, including becoming a condition of supply for all nuclear material and technology and a requirement for all states seeking nuclear energy for the first time; the Agency should be supported and funded in its efforts to achieve universality for the AP, especially through regional outreach.
- Old versions of the SQP should be quickly replaced with the new version; any state with an SQP contemplating seeking nuclear power plants should immediately acquire an AP.
- The Secretariat should continue to help develop the utility of SSACs and RSACS; it should, for instance, institute a forum for regular two-way communication between the Agency and SSACs and RSACs.
- The Secretariat should continue to adopt an expansive interpretation of powers regarding weaponization activities and obtain the necessary analytical capabilities (bearing in mind the non-proliferation implications of obtaining certain types of information).
- The Secretariat should ensure greater transparency in its safeguards implementation process, notwithstanding the need to preserve safeguards confidentiality in some cases; it should, in cooperation with member states, review the use of the confidentiality classification; share more information with states, notably by making the Safeguards Implementation Report more self-explanatory, information-rich and publicly available.
- The Agency should advance its preparations to assist in the verification of appropriate elements of global nuclear disarmament, beginning with an FMCT and US/Russian bilateral nuclear arms reductions.

The Training and Reference Centre for food and pesticide control at the Agrochemicals Unit at the IAEA's Seibersdorf Laboratory. (IAEA Photo by Klaus Gaggl)

PART SIX: PROMOTION OF THE PEACEFUL USES OF NUCLEAR ENERGY

It was envisaged from the outset that the IAEA would promote the peaceful uses of nuclear energy and assist its member states in acquiring the necessary expertise, materials and technology to allow them to fully exploit it. The Agency's mandate was to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." This vision has not, however, materialized quite as expected.

The founding years of the IAEA were marked by breathless promotion of the benefits of the peaceful uses of nuclear energy. The Agency had, after all, been launched after Eisenhower's rousing 1953 "Atoms for Peace" address, which promised atomic miracles ranging from making deserts bloom to electricity that would be too cheap to meter. Yet in its first decade or so, the IAEA struggled to make its mark, as its anticipated functions either disappeared or were purloined by others. The Eisenhower idea of a "nuclear pool" or "fuel bank" managed by the IAEA quickly vanished.[1] The early American and Russian offers of fissionable material had been received with "apathy" (Hewlett and Holl, 1989: 371) by potential recipients, who preferred to deal bilaterally with other states. The IAEA never took possession of such material. There seemed to be little point in possessor states transferring it to the IAEA, either physically or virtually, for it to be then just transferred to recipients. Essentially, states did without the IAEA as middleman.

The role of clearinghouse for nuclear assistance and cooperation between member states also did not eventuate. Instead, the United States had begun providing training for foreign nuclear scientists,

1 The October 1954 second "Preliminary Outline" of the IAEA concept for review and comment by selected countries did not provide for a nuclear pool, since without the Russians it would have been pointless; even with the Russians back in the picture, the United Kingdom and Canada still did not favour the pool idea. In any event, the National Security Council had determined that the United States would "earmark" reasonable quantities of fissionable materials rather than physically handing them over (Hewlett and Holl, 1989: 230).

engineers and technicians, donating or subsidizing research reactors (and fuel) and concluding bilateral nuclear cooperation agreements intended, at least in part, to pave the way for nuclear power reactor sales. The Soviets soon followed with their own programs. The IAEA simply did not have the capacity or expertise, nor the inclination, to manage such interactions.

As for the fanciful notion that somehow the Agency would help provide nuclear power plants to states, this perception also quickly faded. Within a few years of Eisenhower's speech, the Americans realized the barriers to realizing this vision. Nuclear power stations would not be cheap, but expensive, the safety of early models could not be guaranteed and spreading peaceful nuclear technology might help increase nuclear weapons capabilities, not least because all nuclear power plants produce plutonium, a bomb material. States seeking to acquire the full nuclear fuel cycle, through uranium enrichment to reprocessing of plutonium, would essentially acquire the crucial precursors for nuclear weapons. All these factors caused the early promise of nuclear electricity to sour, and the Agency's planned role as the handmaiden of nuclear power generation receded rapidly. The idea of an international fund for financing nuclear plants died for lack of contributors (Potter and Mukhatzhanova, 2012: 85). For their part, states genuinely wanting nuclear power reactors preferred to work directly with vendor states.

There was a renewal of enthusiasm for nuclear energy in the 1970s and 1980s, as the United States, Canada, Japan, France, Russia and other European countries began deploying large numbers of reactors. Seeing a possible role for itself in extending nuclear energy to developing countries, the Agency at times became overwrought in its excitement. As Pringle and Spigelman put it, "There are few more ridiculous documents in the history of nuclear overstatement" than the IAEA's 1974 Market Survey for Nuclear Power in Developing Countries, which projected a potential demand from such countries for 140 nuclear power plants (1981: 389). Only a handful of these plants were ever built and, again, the IAEA's role was marginal.

According to a plan launched at the first GC session in 1958, the Agency did, however, begin technical assistance for such low-level activities as agriculture and medicine, but it failed to match the extravagant promises of Atoms for Peace. The advanced nuclear countries (at this stage, these were only Canada, France, the United States, the United Kingdom plus the Soviet Union) envisaged that they would mostly be providing technical advice and training through the Agency, with minimal financial commitments and certainly not large-scale transfers of sophisticated technology for nuclear reactors or activities such as reprocessing and enrichment, especially in the absence of safeguards. The developing countries, led by India and Egypt, with the support of the Latin Americans and Soviet bloc, fought hard to expand assistance programs to encompass technology transfers and equipment, and keep onerous controls to a minimum. As Bill Barton notes, here too "Arguments were lengthy and acrimonious" (1997: 43).

Fifty-five years later, the IAEA has emerged with a technically well-regarded, wide-ranging peaceful uses program that is significant to its mainly developing country recipients, but still relatively modest in terms of the overall IAEA program of activities. The Agency has two key support roles in the peaceful uses field: one deals with nuclear power generation; and the second with other peaceful applications of nuclear technology. It has three departments concerned with such issues: the Nuclear Energy Department, the Department of Nuclear Sciences and Applications, and the Department of Technical Cooperation, which administers the TC program. The regular budget for 2012 for the three departments is:

- Nuclear Power, Fuel Cycle and Nuclear Science: €33.7 million;
- Nuclear Techniques for Development and Environmental Protection: €38.6 million; and
- Management of Technical Cooperation for Development: €20.3 million.

The latter figure does not include the TC Fund, which finances projects outside of the regular budget and is reliant on voluntary assessed contributions. By comparison, the Agency's budget for policy, management and administration is €75 million, while that for Nuclear Verification is €128.7 million.

The role of the Nuclear Energy Department is to foster "the efficient and safe use of nuclear power by supporting existing and new nuclear programmes around the world, catalyzing innovation and building indigenous capability in energy planning, analysis, and nuclear information and knowledge." This is known as IAEA's Major Programme 1, on Nuclear Power, Fuel Cycle and Nuclear Science. As in other areas of its work, the Agency provides services and advice to member states on nuclear power and the nuclear fuel cycle for:

- continued reliable and safe lifetime operation of present reactor systems and fuel cycle facilities;
- expanded use of nuclear power, particularly for countries currently without nuclear power, or with only small nuclear power programs;
- development of advanced reactor systems and their fuel cycles for the long term;
- capacity building for energy analysis and planning;
- objective consideration of the role of nuclear power for sustainable development; and
- development of nuclear knowledge management, information and communication.

The Nuclear Energy Department is also responsible for technological aspects of radioactive waste and decommissioning as part of the Agency's Major Programme 3, on Nuclear Safety and Security. Since about 2000, with the growth in interest in civilian nuclear energy worldwide, the IAEA resumed its role as a key adviser

to its member states on whether or not they should launch a nuclear power program.

The Department of Nuclear Sciences and Applications, meanwhile, is responsible for the implementation of the IAEA's Major Programme 2, on Nuclear Techniques for Development and Environmental Protection. Key areas identified by the 2002 Johannesburg World Summit on Sustainable Development (WSSD) drive the program: water, energy, health, agriculture and biodiversity, known as the WEHAB topics. The Johannesburg summit reaffirmed the Agenda 21 Action Plan and the priorities identified in the Millennium Declaration. Major Programme 2 focuses on the use of nuclear and isotope techniques — on their own or integrated with other technologies — to assist member states in providing unique solutions to help achieve relevant WEHAB goals. Addressing agricultural productivity and food security, improvement of human health, increased availability of water resources, assessment and management of the marine and terrestrial environments, and industrial applications using radioisotopes and radiation technology, these techniques enhance the contribution of nuclear sciences and applications to sustainable development objectives by strengthening national research and development capacities.

PROMOTION OF NUCLEAR ENERGY

Compared to other aspects of the Agency's work, its nuclear energy program is relatively uncontroversial. According to former US Ambassador to the IAEA Greg Schulte, three anti-nuclear energy states — Austria, Ireland and New Zealand — have had a hand in circumscribing the IAEA's peaceful applications role (2010: 5). Given the lack of influence these states have at the Agency, this seems unlikely, except at the margins. Schulte asserts, nonetheless, that "Friends of Nuclear Energy" (China, France, India, Russia and the United States) were "able to put the agency back into the business of helping countries interested in nuclear power." In any event, the budget for this aspect of the Agency's work is a relatively modest €33.7 million in 2012. After rising slightly in the early 2000s as the "nuclear renaissance" was increasingly heralded, the budget has since plateaued.

Compared to the OECD's NEA or the industry-based World Nuclear Association (WNA), the IAEA is constrained in promoting nuclear energy too enthusiastically by its dual mandate, which enjoins it to both advocate the peaceful uses of nuclear energy and help ensure that this occurs safely, securely and in a non-proliferant fashion. Having learned its lesson in over-optimistically forecasting the growth of nuclear energy in the 1980s, the IAEA is today usually more sober in its projections than the industry or some of its member states. DG ElBaradei claimed: "In fact, I never preach on behalf of nuclear energy. The IAEA says it's a sovereign decision, and we provide all the information a country needs" (BAS, 2009: 9). More pointedly, in regard to the current enthusiasm for nuclear energy, he told the *Bulletin of the Atomic Scientists* in an interview in September 2009 that: "In recent years, a lot of people have talked about a nuclear renaissance, but I've never used that term. Sure, about 50 countries were telling us they wanted nuclear power. But how many of them really would develop a nuclear power program? Countries such as Turkey, Indonesia and Vietnam have been talking about building nuclear power plants for 20 years. So it's one thing to talk about nuclear power: it's another thing to actually move forward with a program" (BAS, 2009: 7).

Even under ElBaradei, however, the Nuclear Energy Department occasionally became overly enthusiastic about nuclear energy, for example, the claim on its website in July 2009 that "A total of 60 countries are now considering nuclear power as part of their future energy mix" (IAEA, 2009b), a figure apparently derived from a list of countries that had at any time and at any level, approached the agency for information on civilian nuclear energy. The Nuclear Energy Futures Project in 2010 identified half of that number with serious intentions of acquiring nuclear energy (Findlay, 2010b: 72–84). Since Fukushima, that number has shrunk even further to less than a dozen countries. Israel, Italy, Nigeria, Senegal and Venezuela are among those that have given up, while Bangladesh, Egypt and Indonesia are still struggling to fulfill their decades-long ambitions. At this stage, Jordan, Turkey, the United Arab Emirates and Vietnam are the most likely to succeed (Findlay, 2011).

DG Amano is now in the unfortunate position of being obliged to continue to promote nuclear energy even while his own country, Japan, is undergoing a fundamental reconsideration of its nuclear energy program, and where the Fukushima accident has convinced several other states to abandon it altogether or end their plans for pursuing it. There will, therefore, no doubt be a drop in the number of states seeking the Agency's advice on whether or not to pursue nuclear energy. In July 2009, IAEA DDG of Nuclear Energy Yury Sokolov estimated that over the next two years the Agency was expected to assist 38 national and six regional nuclear programs, a "three-fold increase from the previous reported period."[2] The Agency was gearing up for even higher demand, but these calculations now need to be reassessed.

Nonetheless, even if the revival is confined to current users and the few successful newcomers, safeguards will likely need to be applied to increasing numbers of civilian nuclear power plants in NNWS. In addition, safety and security expectations, based on IAEA principles, guides and recommendations, are rising — both for existing and new nuclear reactors. The Agency is also likely to continue to play a vital role for states that persist with their investigation of the nuclear energy option, however unrealistic, by urging these newcomers to carefully consider all the requirements for successfully acquiring nuclear energy, notably through studying and adhering to the Agency's exhaustive *Milestones in the Development of a National Infrastructure for Nuclear Power* (IAEA, 2007c). The IAEA should continue to leverage interest in nuclear energy to promote safety,

2 "Finding a role for nuclear: IAEA helps developing countries assess readiness for nuclear power," IAEA staff report, July 21, 2009. Available at: www.iaea.org/newscenter/News/2009/nuclearrole.html.

security and non-proliferation norms, goals and legally binding obligations, not just for newcomers, but for states considering expanding their existing programs. Fukushima provides a golden opportunity for the Agency in this respect.

One challenge facing the Agency in advising states concerning their ambitions for nuclear energy is that it is not mandated or technically competent to advise them on alternatives, especially "green" alternatives with low carbon emissions, much less a holistic national energy strategy. It can refer states to the International Energy Agency, but that is an arm of the OECD and is therefore only obliged to assist its member states — the developed countries. The World Bank may assist in planning and funding developing country energy projects, but there is no truly multilateral energy agency. This is a lacuna in global governance that is beyond the IAEA's ability to fill.

One issue that is occasionally raised is that of statutory schizophrenia: the Agency is both a promoter and regulator of nuclear energy. This has obliged successive IAEA DGs to be axiomatically enthusiastic about the global spread of nuclear energy to any country that desires it (even if the DG and the Secretariat harboured doubts about the wisdom of this), while also being a harbinger of nuclear catastrophe if safety, security and safeguards are not continually strengthened.[3] One potential result, which fortunately has not eventuated, is a conflict of interest within the Secretariat between promoting and regulating nuclear energy. As David Fischer has noted, "Those who know the IAEA well know that these doubts are misplaced. The staff of the IAEA have not tempered their approach to nuclear safety or safeguards because of concern for the interests of the nuclear industry or because they feared that rigorous safeguards or safety measures would push up the cost of nuclear power" (1997: 417). In general, the Agency has judiciously balanced its promotional and regulatory roles. Ironically, this may be due in part to the Agency's much maligned organizational stovepiping, with separate departments for promoting nuclear energy, safety and security, and safeguards. This is usually regarded as deleterious for efficiency, but may have helped avoid the Agency's regulatory functions being subordinated to its promotional functions.

The waxing and waning fortunes of nuclear energy over the years may also be responsible. While the Agency was swept up in the general enthusiasm for spreading nuclear energy worldwide in the 1970s, notably to developing countries, it has since adopted a more sober approach. For instance, it now hedges its bets by issuing high and low estimates of future deployment of nuclear reactors. Since the so-called nuclear renaissance emerged about 2000, the IAEA has, far from colluding with industry, on balance probably helped dampen its wilder expectations. By setting out in lengthy technical documents the arduous requirements that states must fulfill before even considering the adoption of nuclear energy, the Agency has undoubtedly deterred some states altogether, and caused others to look more sagely at the enormous human, resource and financial investments required.

Another factor that has prevented the Agency from being "captured" by the nuclear industry is that it is an organization of governments, rather than nuclear vendors or operators. Diplomats dominate the Agency's governance, and nuclear scientists and technologists do not predominate in the upper levels of the Secretariat. Being an organization of states, the views of the industry, for good or ill, is largely mediated through diplomatic representatives to the Agency. It therefore naturally errs on the side of expanding multilateral nuclear governance (through international law and norm building), rather than spreading the technology itself. In fact, unlike national atomic energy agencies, the IAEA does not have the close relationship to the nuclear industry that might be expected from its mandate (regrettably so when it comes to issues such as nuclear safety and security).

More problematic than an intra-agency conflict of interest, is that the Agency's dual statutory roles attract support from different, and sometimes opposing, constituencies within the IAEA membership. Developing states, most of which have had no desire to acquire nuclear weapons and have regarded nuclear proliferation, safety and, lately, security, as largely Western preoccupations, have, as already noted, from the outset seen the Agency's prime value as a provider of technical assistance in the peaceful uses of nuclear technology.[4] The United States also originally saw the Agency as a vehicle for promoting peaceful uses, notably sales of US nuclear reactors and other peaceful nuclear technology. Over time, though, the United States has increasingly stressed the Agency's role in preventing the proliferation of nuclear weapons and ensuring the safety and security of peaceful nuclear activities. Other Western states eventually fell in line with the goals of the United States. The split in the IAEA membership on this issue has only grown as membership from the "third world" increased and the NAM began to pay more attention to the Agency. These differences have manifested themselves in political and budgetary battles, most notably in regard to TC.

TECHNICAL COOPERATION

Although there is no mention in the Statute of what would become the TC program, it has come to be viewed by the developing countries as a major reason for joining and staying in the Agency, and for lending their support to other Agency activities that they see as only of marginal interest or benefit to them. Since TC is not mentioned in the Statute, it is excluded from the Agency's regular budget. Instead, it is dependent on the wealthier states for "voluntary" funding (the budgetary implications will be considered in the section on Finance and Budget). Many developing countries have, accordingly, treated TC as yet another development assistance program to which they are entitled. For some states, it is apparently even seen as "reparations" for the treatment they suffered during the colonial era. For others,

3 See, for example, ElBaradei (2007).

4 For the developing countries' viewpoint, see (Sreenivasan: 2008).

it is viewed as the partial and grudging fulfillment of the original promise of Atoms for Peace, which "lured" them into the IAEA in the first place.

Major donor countries, on the other hand, have often resignedly viewed TC as part of the price they have to pay for the IAEA being able to continue to give priority to nuclear safeguards and safety, and, more recently, nuclear security. These countries have tended to ignore inefficiencies and other difficulties with the program, in order not to disturb the *modus vivendi* with the developing world on the TC issue. The DDG for the program has always been from a developing country, making Western "interference" in TC even more delicate. Nonetheless, major donors have long resented the implied extortion involved in pegging TC funding goals to the safeguards budget, as well as the program's longstanding resistance to modern management practices.

Complaints about the program's management and operation are legion. It has been described as the "poor cousin" of the Agency's activities. First, year after year the program has, by and large, simply bundled together most of the proposals put to the Secretariat by its developing country members. There has, until recently, been little or no priority setting for the TC program as a whole, or at a regional or national level. Second, there has been a poor integration of projects into national development goals, largely because the recipient countries resist intrusion into their prerogatives in such matters. Third, the program has been subject to little quality control, either in pre-project assessment, post-project evaluation, or based on absorptive or sustainability capacity. Finally, there has been a surprising lack of transparency about the program. The BoG, for instance, has traditionally received the complete list of TC projects for an upcoming biennial meeting — sometimes numbering close to 1,000 individual projects — only a week or so in advance. Not even the largest and most capable delegations would have a chance of perusing them carefully. The program has widely been seen as "demand driven," rather than "needs driven."

TC has also tended to benefit the larger, wealthier developing countries that already have nuclear activity of some description, rather than the least developed countries. A 2009 US Government Accounting Office (GAO) report identified 13 states that should be "graduated" from TC (2009: 48–51) as the following high-income past recipients of TC: Brunei Darussalam; Israel; South Korea; Saudi Arabia; Singapore; the United Arab Emirates; the Czech Republic; Malta; Portugal; and Slovenia. All of these states can afford to pay for IAEA services that they require. In addition, Argentina, Brazil, Chile, China, India, Indonesia, Iran, Malaysia, Mexico, South Africa, the Baltic States (Latvia, Lithuania and Estonia), Russia, Turkey and Venezuela should all voluntarily forego TC and leave the program to more deserving states (GAO, 2009: 48–51). The most radical idea would be for TC to be restricted to the Least Developed Countries (LDC) officially recognized by the UN; currently they number 49.[5]

There have been several reviews undertaken of TC and proposals for its reform over the years. The BoG undertook its first review in 1983, directing the Secretariat to help developing countries establish priorities in drawing up requests for assistance (IAEA, 1984: 20-21, paras 61-66 and Fischer, 1997: 365). The Agency also began to systematically evaluate the impact that TC projects were having in the beneficiary countries, establishing a special unit for this purpose in the Department of TC in 1983 (Fischer, 1997: 335). A 1987 review concluded that the Secretariat had responded effectively to TC needs; the two most common problems were identified as adequate training of staff selected to carry out the projects and shortages of national counterpart staff (Fischer, 1997: 335). The BoG agreed, in November 1986, to change from a one-year to a two-year cycle for TC. Since this experiment was successful in giving the Secretariat and states more time to prepare and technically appraise projects, the BoG instititionalized it in 1991. In 1992, the BoG again established an informal Working Group on the financing of TC, but it was unable to reach agreement on specific proposals.

The BoG endorsed, in 1995, the DG's proposal for a Standing Advisory Committee on Technical Assistance and Cooperation, consisting of 12 members from developing and industrialized member states, to advise him on TC, particularly on policy and strategy and to recommend improvements (Fischer, 1997: 335). In 2002, the Agency's OIOS made numerous recommendations for improvement, resulting in the *Technical Co-Operation Strategy: The 2002 Review* (IAEA, 2002b). Three new concepts were developed to improve TC delivery: Model Project; Country Programme Framework; and thematic/sectoral planning. RBM was supposed to be applied in the case of all three concepts.

Despite these initiatives, critics of TC remain. A 2009 GAO report (GAO, 2009) found limited information was available on TC project proposals: 97 percent of them consisted of only a title. Moreover, there were: inadequate performance metrics; no criteria for determining when states should be "graduated" from TC as they become more developed; and no systematic review of project completion and results. Unfortunately, the Agency did not provide the GAO with an opportunity to interview relevant IAEA officials who were overseeing TC projects.

The Agency is aware of these difficulties. Its most recent annual TC report (2010) noted that only 68 percent of the 195 accepted, or partially accepted, OIOS recommendations made between 2002 and 2009, have been fully implemented. This was only a 1.3 percent improvement over the previous year, which had been attributed, in part, to "expansion of the Programme Cycle Management Framework IT platform" (IAEA, 2010f: v). Problems in "rolling out project results to end users" were highlighted, "particularly the need to reach farmers" (IAEA, 2011dd: viii). The implementation rates actually decrease for recommendations issued in 2007, 2008 and 2009 (76 percent, 27 percent and 3 percent respectively), although "follow-up activity" in early 2011 had, reportedly, increased the implementation rate considerably (IAEA, 2011dd: 19). Common problems in TC

5 See www.un.org/esa/policy/devplan/profile/ldc_list.pdf.

projects identified by the OIOS included: limited baseline data availability and poor tracking of project results at the "outcome" or "impact" level. Evaluations noted that TC projects should be monitored more systematically and "their benefits assessed in terms of the real achievement of project objectives and sustainability" (IAEA, 2010f: 9).

The program implementation rate in 2010, meanwhile, was only 76.6 percent, less than the 77.3 percent in the previous year. At the end of 2010, active projects totalled 890, while 384 were concluded during the year and six were cancelled (IAEA, 2011dd: 1). Member states are supposed to have Country Programme Frameworks (CPFs) signed with the Agency, which define mutually agreed priority development needs and interests to be supported through TC. While 23 new CPFs were signed in 2010, 41 were still in preparation and only 65 were already in place. The Agency is also aware of the problem of weaning states from TC as they become wealthier, although this is a delicate manoeuvre for any multilateral body, and the Agency calls it "encouraging self-reliance" (IAEA, 2002b: 7). Many TC projects in fact consist of expert and lecturer assignments, meetings, training courses, fellowships and scientific visits, the costs of which could be shared with other organizations. One commendable collaborative initiative is involvement with the WNA in establishing a World Nuclear University.

Four program evaluations were carried out in 2010 by the OIOS, into: safety of nuclear installations; the FAO/IAEA Agriculture and Biotechnology Laboratory; project planning and achievement of TC objectives; and the function and structure of the National Liaison Officers (NLO) scheme designed to improve communication and coordination between the IAEA and its TC projects in the field. The report on the laboratory was highly positive. On TC project planning and achievement of objectives, the inspectors concluded that TC projects were "relevant to Member State needs, that project planning information was well disseminated, and that Agency inputs were effectively used for the transfer of technical know-how and the enhancement of national scientific skills" (IAEA, 2011dd: 19). Although most intended TC project objectives were achieved, the report pointed out that some could not be satisfactorily achieved, usually due to poor timing of policy decisions and weak national commitment. Sustainability was, however, achieved in many instances, and appeared to be linked to a focus on the creation of key national institutions, inclusive planning involving multiple stakeholders, and collaboration among regional peers through regional TC projects.

On the use of national liaison officers, problems were clearly rife, indicating that even when the Agency makes useful reforms, it struggles to bring member states along with it.

Issues of concern identified included the seniority of the person holding the NLO position, limited experience in project management, limited English language proficiency, insufficient knowledge of the Agency's planning processes, strategies and policies, and an absence of critical qualifications in a significant number of NLOs. The report noted that the national institution that hosts the NLO has the duty to fully support and ensure that NLO functions are accomplished successfully, and that decision makers in Member States, including their Permanent Missions, should be fully aware of the importance and nature of the NLO's work, and the resources necessary for carrying it out (IAEA, 2011dd: 19).

In fairness, the inspectors noted that as the NLO Guidelines were enacted only two years before, it was too early to expect major changes.

It is clear that the Agency is in the process of instituting further, potentially significant, changes to the TC program. DG Amano appointed a new DDG for Technical Cooperation, Ghanaian Kwaku Aning, who has been in the position since January 2011. Transparency has notably increased. Between 3,000 and 4,000 proposals for the next biennial were made available to member states in November 2011 on the IAEA website as a "non-paper." The proposals were still in rough form (without the Secretariat's editorial and formatting assistance) about seven weeks in advance of a decision being required. This permitted all member states to assess the proposed projects, enabling unsuitable ones to be weeded out early and allowing the Agency to assist states in developing the most promising ones. In the past, few projects have been rejected on substantive grounds, while those that were set aside because they could not be financed through the program were often taken up by donor states according to their own priorities (developing countries have criticized this system as a way of promoting Western issues such as non-proliferation and nuclear security).

Vetting projects in terms of safety, security, and non-proliferation considerations (see below) is now well established. In addition, the relationship between TC projects and the operations of other departments will be better considered, as well as the capacity of recipients to absorb assistance. The Agency will also begin to assert its own priorities, not just those of requesting states, in an attempt to turn the program into "needs driven" rather than "demand driven." As one of his first initiatives on taking office, DG Amano deftly made fighting cancer the IAEA's developmental priority for the year, thereby helping bring some focus to TC.

DDG Aning is proceeding slowly and methodically to achieve reform, and it is not yet clear whether there will be significant resistance by member states. There is a strong argument to be made that professionalizing TC will benefit developing countries, not only by improving the quality of the projects themselves, but also in encouraging and reassuring donors and potentially making them more willing to provide additional funding. Although the Agency is not obliged to do so, it is increasingly involving itself with other UN bodies in seeking to harmonize TC with other development assistance, and to leverage synergies through the UN Development Group, comprising all United Nations and related agencies involved in development assistance. The Agency has taken part in developing the UN Development Assistance Frameworks (UNDAF) for 48 states, and signed agreements in 2010 with five (Azerbaijan,

Georgia, Kazakhstan, Tajikistan and Uganda), bringing the total to 14 (IAEA, 2011dd: para. 55). TC projects are, thus, reflected in the UNDAF Action Matrix. Close contacts were also established with the UNDP Regional Bureaux and UN Country Coordinators, to help ensure that TC projects contribute in an integrated and harmonized fashion with overall development goals. The external auditor has described previous IAEA engagement with UNDAF as "poor," notes that not a single UNDAF has yet been signed with a country in Asia or Latin America, urges the Agency to better integrate itself with the international development assistance community and bluntly says "the Agency should consider itself a development organization and act as such" (IAEA, 2011a: 30).

Increasingly, the developed, donor countries have a self-interest in providing more funding to TC, to the extent that many projects now involve helping developing countries to improve their national capacity for ensuring nuclear safety and security. As the 2010 TC annual report notes, "ensuring nuclear safety and security is a key factor in all TC projects" (IAEA, 2011dd: vii). Recipients are required to sign a Revised Supplementary Agreement governing TC projects, which contains provisions relating to safety standards and measures, peaceful use undertakings, physical protection and the transfer of title to equipment and materials (IAEA, 1979). As of 2010, 115 member states had signed such agreements.

At least one major donor has seen fit to increase its contribution to peaceful uses through the Agency, to encourage others to do likewise and as recognition of the "bargain" embodied in the NPT. In May 2010, the United States announced the Peaceful Uses Initiative (PUI) at the NPT Review Conference (IAEA, 2011b: 6), pledging US$50 million to kick-start it. The plan is to raise US$100 million in extra-budgetary contributions over five years for Agency activities, including, but not limited to: uses of nuclear energy in the areas of nuclear power; infrastructure development; food security; water resource management; and human health. Much of this will be directed to the TC program.

The Proliferation Issue

An issue that has dogged the TC program intermittently is the possibility that technical assistance of particular types, especially that which would help a state develop a nuclear fuel cycle, might contribute to the proliferation of nuclear weapons. This would naturally be the antithesis of the Agency's purpose. The issue first arose after the 1974 Indian nuclear test. India had been a huge recipient of assistance, not only through the Agency, but also from the United States and the British Commonwealth's Colombo Plan. After India conducted its so-called peaceful nuclear explosion (PNE) in 1974, the Agency quietly stopped what little assistance it had been providing to member states in respect of "sensitive" technologies such as reprocessing and enrichment (Fischer, 1997: 333). In 1977, the BoG finally agreed that safeguards would normally be applied to a TC project if it made a "substantial contribution" to a "sensitive technological area" — namely, enrichment, reprocessing, production of heavy water, handling of plutonium or manufacture of MOX fuel (Fischer, 1997: 333). As David Fischer puts it, "The imprints of London Club and NSG guidelines were apparent in this decision and it was sharply criticized by Governors not party to the NPT." After four years' study by the Secretariat, in 1979 the BoG approved a revised version of the Guiding Principles and General Operating Rules for the provision of TC, preceded by "an unusually heated debate and roll call vote" (Fischer, 1997). The revision sought to avoid the misuse of TC for PNEs (which even though provided for in Article V of the NPT had now fallen out of favour on non-proliferation grounds (Findlay, 1990). The non-NPT states objected that this was neither required by, nor in conformity with, the Statute, but were overruled.[6]

TC projects did, however, continue to assist states in other fuel cycle activities, such as in regard to uranium mining and processing, and nuclear research that might assist in a nuclear electricity program. Iran, Iraq and Syria, all subsequently accused of violating their safeguards agreements, have been recipients of TC. At US urging in 2006, the IAEA refused to support a TC proposal from Iran requesting assistance for a heavy water reactor at Arak, due to concerns that it could serve as a source of plutonium for nuclear weapons. Since then, the United States has unilaterally examined all TC proposals for proliferation implications. However, neither the Agency nor the United States has attempted to stop TC projects in India, Pakistan or Israel, which are all IAEA member states but not party to the NPT. Similarly, TC is still provided to states without comprehensive safeguards agreements or APs.

Moreover, although the US Department of Energy and the national nuclear laboratories identified 43 of the 1,565 TC proposals they examined between 1998 and 2006 as having "some degree of potential proliferation risk," the BoG proceeded to approve 34 of them (GAO, 2009: 7). The Agency does systematically scan TC proposals for proliferation potential now. However, the Agency told the GAO in 2009 that under the Agency's Statute, the Secretariat is "powerless to limit or condition TC assistance to specific countries, even in cases where countries have been deemed by the Board of Governors to be violating their IAEA obligations or in cases where recipient countries were suspected of being engaged in undeclared clandestine nuclear activities" (GAO, 2009: 14). There is, however, nothing to stop the BoG itself making such a decision.

This question has arisen most recently in the case of Syria. After the Israeli bombing of a suspected secret Syrian reactor in September 2007, the TC Department was preparing to accede to a Syrian request for assistance. The United States vehemently, but unsuccessfully, opposed the continuation of TC for Syria at a November 2008 BoG meeting (Hibbs and Persbo, 2009: 17). DG ElBaradei insisted that Syria was entitled to continuing TC, as it was "innocent until proven guilty," at least implying that assistance, in theory, could be denied.

6 Argentina, Brazil and India voted against; India and Argentina withdrew from TC, while Brazil and Pakistan were prepared to accept the revised guidelines on a case-by-case basis; Argentina later returned to the program, while India only participated in training courses.

In November 2011, Syria again requested TC assistance (under DG Amano) with a feasibility study and site selection for a declared nuclear reactor project (Othman and Jouhara, 2011). US Deputy Ambassador Robert Wood opposed it, declaring that: "In principle, it is our view that a state found in non-compliance with their (IAEA) safeguards agreement should have certain technical cooperation projects curtailed or suspended." Conceding that there was unlikely to be agreement in the BoG to cancel the project altogether, he "strongly" urged the Secretariat to monitor the project closely and report to the Board "as appropriate" (GSN, 2011c).

While the number of TC projects with any non-proliferation implication is probably small, and the amounts of money involved and types of assistance are relatively minor, there is a question of principle involved. To this end, the Agency should continue to strengthen its oversight of TC projects and make recommendations to the Board where it has concerns. Ultimately, it is up to the Board to make a determination and refuse the proposal or cancel the project if it has commenced. Having greater access to the complete details of all proposals at the earliest stages will assist both the Secretariat and member states in this effort.

CONCLUSIONS

The IAEA's activities and programs for promoting and assisting states in the peaceful uses of nuclear energy are, on the whole, laudatory, effective and rightly fulfill one of the original promises of the Atoms for Peace concept, the Agency's Statute and the NPT. The TC program is in most need of further strengthening and reform. This will benefit not just recipients and donors, but will enhance the reputation of the Agency as being effective and efficient. Although there has been resistance from some developing countries to reform the TC program, there is a strong case to be made that a more effective and efficient program, one geared to legitimate and integrated developmental needs, will serve recipient states better, not least by encouraging donor states to give more.

RECOMMENDATIONS

- The Agency should pursue the intimated reforms in its TC program: greater transparency; earlier notification and greater detail about proposed projects; prioritization from the Agency's point of view, not just those of recipients; greater attention to absorptive capacity and sustainability criteria; quality control of project implementation; and better post-implementation review.
- The Agency should stop providing equipment and services that can be obtained by states commercially, especially those with increasing financial resources of their own; the Agency should increasingly move to an advisory and human capacity-building role (see Part Nine: Finance and Budget for further detail).
- Aside from TC programs directed at improving member state capacity in the areas of safeguards, safety and security, the focus of TC should be redirected to the officially designated LDCs; states transitioning from developed to developing country status should be diplomatically weaned from TC and "graduated" from the program.
- The Secretariat and the BoG should be attentive to the potential proliferation implications of certain TC projects; states in dispute with the IAEA or under investigation for non-compliant activities should not receive TC assistance, except where they are directly relevant to humanitarian needs.

IAEA DG Yukiya Amano. (IAEA Photo by Dean Calma)

PART SEVEN: MANAGEMENT AND ADMINISTRATION

Despite the highly political atmosphere in which it often operates, the IAEA Secretariat has largely retained its reputation as an objective, impartial and professional body that is well managed and administered, especially compared to the UN norm. This may be due, in part, to the highly technical nature of its safety, security and safeguards activities and the prized scientific and technical advice and assistance it provides to member states. It may also be attributed to the professionalism of the Agency's inspectorate and other groups of experts, which have, of necessity, required personnel with scientific and/or technical qualifications, discretion in handling highly sensitive information and robustness in dealing with physical and political obstacles in the field. The willingness of states to provide additional voluntary funding for various IAEA programs, notwithstanding the imposition of ZRG on the regular budget, is a signal that member states see the Agency as effective and efficient.

Nonetheless, there are accusations from certain member states and other stakeholders that the Agency is not cost-effective enough; not driven by RBM, despite its claims to the contrary; insufficiently transparent; lacking in metrics of success; and inadequate in its planning and financial processes. It is beyond the scope of this study to examine the IAEA's management and administration in depth. The following will cover key issues facing the Agency in the areas of management and administration.

THE CURRENT STATE OF TRANSITION

The management and administration of the Agency is currently in a state of transition due to the appointment of Yukiya Amano as DG in late 2009. The appointment of a new head always provides the opportunity for the organization to change its management and administrative structures and procedures. As the US ambassador put it in a cable leaked by WikiLeaks, "The IAEA transition that will come as DG ElBaradei's term ends November 30 provides a once-

a-decade opportunity to overcome bureaucratic inertia, modernize Agency operations, and position the new director general for strong leadership from the DG's office" (Borger, 2011). The US mission expressed concern that despite Amano's intentions on taking office, new appointments to key positions would take time, as several senior officials had recently received promotions or extensions of their contracts, or both. The main US concern was officials, particularly in EXPO, whom the United States had found "troublesome" over policy towards Iran and Iraq (Borger, 2011). EXPO had reputedly "grown in influence as the Agency faced ever greater and more complex challenges" (Hibbs and Persbo, 2009: 11) such as Chernobyl, Iraq, North Korea, South Africa and Iran.

Amano in fact moved relatively quickly to effect personnel changes. He has replaced all of the DDGs with new appointees. He also took steps almost immediately to absorb EXPO into his office, with the obvious aim of neutralizing its influence. DG Amano has thereby strengthened his own office, raising concerns on the part of some diplomats in Vienna that this will make decision making in the Agency overly centralized and insulate him from Agency-wide advice. One observer has noted: "vertical stovepiping and centralization is in."[1] The DDGs have, according to this source, been subordinated to three Special Assistants to the DG (these are not line positions, nor filled through regular hiring procedures) and to the Assistant DG for Policy, who now sits next to the DG on the podium in Board meetings. Decisions are reportedly being handed down from the top with little or no transparency or explanations, and reverse assessments or requests for rethinking are not welcome (Borger, 2011). Others interviewed for this project had different, less alarmist views, welcoming the recalibration of the Agency's management structure and style.

Some of the informal changes in the top management arrangements may be a legitimate attempt to overcome the disadvantages of the flat management structure of the Agency discussed in the section on Governance and Leadership above. A more formal solution (but one that may, or may not, involve amending the Statute, depending on legal opinion), would be, as suggested, to appoint a permanent single DDG, with the customary duties of such a position, with the current DDGs becoming a third level of management.

It is, in many respects, still too early to evaluate the impact of DG Amano's changes, especially as the last of the new DGs are only beginning to settle into their positions. As Nils Brunsson reminds us, organizational structures are both formal and informal: the formal structure can be changed at "the stroke of a pen" for the purposes of demonstration or display to the outside world, whereas the informal structure is what produces action or inaction (1989).

MANAGEMENT AND ADMINISTRATIVE REVIEWS

Over the years, the IAEA has been subject to several forms of external review, although only one has focused on management and administration of the Agency as a whole. Several Vienna-based missions of member states, notably the Geneva Group, take a continuing interest in such issues and political or parliamentary delegations sometimes visit the Agency for discussions with senior officials that might cover these issues (although usually not in much depth). The most detailed and probing national investigations are those carried out periodically by the US GAO[2] and Congressional Research Service[3] but these tend to concentrate on the management and administration of specific programs like safeguards and TC rather than the Agency as a whole.

Like other international organizations, the IAEA has its own internal audit and review processes, including those conducted by the Office of Internal Oversight and Services, which cover not just financial matters, but also management and administration. The Agency is also subject to continuous external audit by a national auditor chosen for a two-year term by the GC from among its membership. States actively compete for the position. For the past eight years it has been Germany, with the United Kingdom and India among previous auditors. The Auditor is required to operate on the Single Audit Principle: that is, the audit is conducted according to the Agency's audit procedures, not those of the state conducting it (otherwise auditing chaos would ensue). This explains why national parliamentary or other enquiries into the Agency need to be careful not to give the impression that they are second-guessing the official auditor (he recently complained that an EC verification mission had come close to violating the Single Audit Principle) (IAEA, 2011a: 25-26). For several years the BoG itself had a working group on financing of the Agency's activities.

In terms of in-house management review, in January 1998, DG ElBaradei initiated the practice of annual management conferences involving senior managers, held at a venue away from Vienna. The agenda varies, but has encompassed the following topics:

- coordination and policy (enhanced program coordination and greater communication throughout the house);
- program (improved processes for budget-setting, program evaluation and reporting);
- management structure (increased delegation of authority and greater streamlining of clearance procedures);
- people management (improvements in recruitment, training and staff motivation) (Campbell et al., 2002); and
- external and internal communications risks.

1 Private conversation with the author, Vienna, October 2011.

2 See GAO (1998, 2005 and 2009).

3 See Donnelly (1988).

Although the results of these meetings are, naturally, confidential, the fact that they are held is an indication of an organization open to dealing with such challenges.

COMMISSION OF EMINENT PERSONS

In 2008, DG ElBaradei appointed an Independent Commission of Eminent Persons to examine the role of the IAEA to 2020 and Beyond (the so-called 20/20 Commission), which reported in May 2008 (IAEA, 2008h). Led by Ernesto Zedillo, former president of Mexico, the commission was informed by an extensive background report prepared by the IAEA Secretariat (IAEA, 2008a), which had a great influence on the outcome of the inquiry.

Although it was not meant to focus on management and administration, but on how the Agency should equip itself overall to meet the challenges of the coming decades, the commissioners ranged far wider, making the exercise far less useful than it might otherwise have been in honing in on the Agency's existing shortcomings and ideas for strengthening and reform. While several specific ideas were put forward regarding finance and personnel matters (which will be considered in the appropriate sections of this report), recommendations on management and administration were essentially limited to the following vague admonition: "The needed increase in funding must be accompanied by a renewed and transparent effort by the IAEA Secretariat to improve on the Agency's already impressive record of efficiency. It must seek every opportunity to develop a management culture that emphasizes accountability, readiness to accept change and effective coordination with other organizations" (IAEA, 2008h: 30).

THE MANNET REPORT

In 2002 the Secretariat commissioned the first and to date only management consultancy study of the Agency's operations. Conducted by the Swiss consultancy company MANNET, the report, *At What Cost Success? Final Report of the External Review on the Management Processes of the International Atomic Energy Agency* (Campbell et al., 2002), was not released publicly. The DG intended for it to be an "objective, impartial and independent external review of the IAEA's management processes." According to Agency officials, it was the Secretariat's response to the reluctance of member states to provide more funding for the Agency while at the same time increasing the Agency's workload. Member states, especially the Geneva Group, comprising the Western countries that provide most of the Agency's budget,[4] argued (as they still do) that the Agency should be able to continue finding "efficiency" savings, despite having been subjected to ZRG budgeting since 1985. The Agency argued that it had made continuing efforts to minimize costs but that after several years such cost-cutting measures could no longer reap results and, by constraining the Secretariat's capacities, were becoming counterproductive.

Some Western member states claim that they, not the Secretariat, insisted that the Agency conduct such an exercise rather than simply requesting additional funding in each year's budgetary process. They further allege that the DG intentionally shackled what was intended to be a wide-ranging study by restricting it to just three months and giving the management consulting team limited access to Agency documents and meetings. The report itself conceded that the MANNET team had "limited observation of meetings and of managerial behaviour" (Campbell, M. et al., 2002: 5) and did not examine the Agency's financial management and budgetary systems. The authors of the report, however, claimed that they had interviewed a "wide range of individuals"; had access to extensive background materials, supplemented by documents they specifically requested; met with representatives of member states at an informal meeting and received submissions from them; and, in the penultimate week, conducted four feedback sessions with staff to report on the issues arising from the discussions and interviews.

In any event, the report, in the Secretariat's view, fulfilled its function. MANNET's overall assessment was that the Agency was "performing well and it has a good international reputation." Member states had reported that they were generally satisfied with the quality and services offered. The report noted that over the previous five years, the DG had sponsored multiple initiatives for reform and that the Agency could be characterized as "in transition." Under pressure from major donors, including other international organizations (Mathiason, 2011: 246) since the mid-1990s, the Agency had, the report noted admiringly, moved to adopt an RBM[5] approach in the 2002-2003 planning cycle. The team said it had documented that the IAEA had "consistently held down costs."

Nonetheless, MANNET also concluded that despite its efficient management of resources, the IAEA was showing "signs of system stress" and could not sustain its level of activity or respond to increasing demands without concomitant increases in resources. Examples of such stress included: competition between departments; "reliance on personal networks to get things done"; unclear lines of authority, the evolution of differing and sometimes conflicting systems; an exponential increase in planning; and reporting requirements and tensions surrounding the rotation policy (see human resources section of this report for details) (Campbell et al., 2002: 9). After years of deferred investments in people, systems and processes, the Agency now needed to upgrade its "management processes and delivery mechanisms." Particularly biting criticisms were of the Agency's "individualist organizational culture" and of managers' failure to deal with instances of "chronic under-performance. "We note," the report said, "the paradox of the Agency

4 These countries are Australia, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Russia, Spain, Sweden, Switzerland, the United Kingdom and the United States. See Mukhatzhanova (2011).

5 RBM was introduced into the public sector, both nationally and internationally, in the 1990s. The UNDP was among the first UN organizations to adopt it. For an evaluation of RBM in an international organization, see UNDP (2007).

being described as a rigid and traditional hierarchy but one where there is in fact little discipline — people do what they want (if they disagree with a rule they ignore it or go around it, and they are not held accountable for their behaviour" (Campbell, M. et al., 2002: 16).

The report's "primary recommendation" was that the DG develop a "comprehensive and integrated change management strategy as a matter of some urgency to overcome the systems stress and, above all, to embed the change in organizational culture" (Campbell, M. et al., 2002: 20). It recommended a "One House" approach (much mentioned subsequently by DG ElBaradei) in which all departments would work together towards the same goal and speak with one voice to the outside world. Overall, the report gave the impression of being somewhat rushed and of applying boilerplate management concepts and solutions to a unique agency. It was remarkably vague on the topic of how IAEA should reform its "management processes."

The MANNET report did apparently have one lasting effect: it is claimed that it led directly to the decision by member states in 2002 to increase the Agency's budget, albeit over several years, thereby ending for a time the imposition of ZRG (see finance section for further details). According to former DDG David Waller, the report led to the adoption of an Agency-wide information management tool, the AIPS, which permitted all of the Agency's data to be managed in the same way across all departments. Previously, individual departments, divisions and offices had their systems, resulting in poor or no connectivity. This is a common legacy problem dating from the earliest introduction of computers into organizations, but in the Agency's case, it reinforced its existing tendency towards "stovepiping" into several disconnected functions.

In the decade since the report was commissioned, many areas of the Agency have paid only lip service to the report's recommendations and taken little action to implement them. John Mathiason, an expert on international secretariats, says RBM is an approach to planning, implementation and evaluation that is "particularly applicable to the international public sector" (2011) and that the Agency has been successful in implementing it (unlike the UN itself). The view within the Secretariat is not so sanguine. Some departments in the IAEA have been better than others, notably the largest, the Safeguards Department. Ten years ago, MANNET noted that the RBM approach was introduced into the IAEA before staff had been trained on the complexities of the system, resulting in uneven adoption of RBM in various departments and an increase in the workload (Campbell, M. et al., 2002: 13); these teething problems have now, presumably, been overcome. More generally, where RBM has not worked well in international organizations, it has been, according to Mathiason, for two reasons: Secretariat officials have resisted being held accountable for results outside their control, and governments have not used performance data to evaluate proposed plans and budgets. Some of this is surely applicable to the IAEA. However, there are others who are skeptical of the whole RBM approach, especially when an attempt is made to apply it to areas where results are difficult to quantify or negative, such as continual findings that there is no evidence of non-compliance with safeguards. Currently, RBM has fallen out of favour and has been replaced with the concept of CBP. A Quality Control appointment has been made and the plan is to take a subset of projects and scrutinize them for CBP.

Other enduring criticisms of the Agency are that it remains "stovepiped"; lacks modern management approaches and internal transparency; and is in some respects too centralized, while in others too decentralized (for instance, there is a proliferation of programs and offices but labyrinthine procedures for "signing off" on decisions).

These are common managerial challenges that many organizations struggle with. In the case of UN-type organizations, a number of factors make the problems more difficult: staff of many different nationalities, with different cultural backgrounds; pressure from member states to hire their own nationals, regardless of whether they are competent and qualified for the job;[6] and requirements for "regional" (and implicitly political) balance. In the Agency's case, the stovepiping problem may never be entirely addressed because of the differing role and cultures of different departments. While the safeguards department tends to keep information to itself, due to the confidentiality requirements of the safeguards system, the peaceful uses department is in the business of disseminating its message as widely as possible. Change also requires funding and, for 20 years, member states have been largely unwilling to provide the necessary funding for fundamental change to occur.

STRATEGIC PLANNING

The IAEA has never had a proper strategic plan in its 55-year history. The closest it has come is the five-year Medium-Term Strategy (MTS), initiated by DG ElBaradei. The latest such document covers the years 2012–2017 (IAEA, 2011s). The MTS is developed through interaction between the Secretariat and an open-ended Working Group established by the BoG. It is meant to serve as the organization's strategic plan for the coming five years. It purports to "provide overarching guidance and serves as a roadmap to the Agency's activities during this period by identifying priorities among and within programmes based on such considerations as recent technological trends, emerging needs and the political and economic and social background." It is also supposed to serve as a "general framework and guide" for the preparation of three program and budget cycles using the "results based management approach" (IAEA, 2011s).

In fact, the document is so general and vague that it is of only limited use for planning or budgetary purposes. It is essentially a list of all the activities that the Agency currently carries out, without any prioritization. The current version has even dropped the structure of the MTS 2006–2011, which at least made an attempt at differentiating

6 Senior management complain that they spend inordinate amounts of time coping with representations by Vienna missions pressuring the Agency to hire their nationals.

between substantive and functional goals and sought to establish goals and objectives (IAEA 2005a). The reference it makes to "results based management" is pure tokenism: at the end of each section it says essentially that success will be measured by success. Part of the problem is that the BoG attempted to draft the current version but political differences resulted in the Secretariat being asked to produce a draft, which then "had the edges knocked off it" during subsequent "negotiations" among BoG members.

Inklings of a real strategic plan can be found in the annual *Agency's Programme and Budget*, although this document has an entirely different purpose. It sets out objectives for each major program, along with main outputs, expected outcomes and performance indicators (IAEA, 2011b); however, these are contained in a large and complex document that few are likely to delve into. This is partly due to member states themselves, which often insist that the Secretariat include information, tables and documents relating to their own pet projects. The 2011 version incorporates, for the first time, a new section called "Major Programmes at a Glance," helping make the document "easier to navigate" (IAEA, 2011b: Part 1.2). This section includes paragraphs for each program listing "Major issues and challenges" and "Prioritization." The Secretariat, in drafting the document does attempt to link every expenditure item to a relevant item in the MTS, no matter how obscure, to ensure that the BoG does not dispute the proposed spending. However, there is no overall prioritization of goals, programs and activities as there would be in a true strategic plan. Among the various departments of the Agency, the Safeguards Department's 2010 strategic plan, discussed earlier, is the first and only of its kind.

In the corporate world, the fact that an organization the size and stature of the IAEA does not have a strategic plan would be seen as completely anomalous. Not only does this leave the Agency subject to the whims of member states and passing fads, but it provides no comprehensive, coherent basis on which it can measure progress. It also helps the Agency avoid setting priorities among and rationalizing its mind-boggling myriad of programs. While any attempt at negotiating a strategic plan would likely, as the MTS exercise indicates, embroil the Secretariat in endless and ultimately fruitless negotiations with its member states, it should be possible to produce an internal document using the same processes as the Safeguards Department. Unlike the Safeguards Department's strategic plan, however, it, or at least its broad outlines, should be presented to the membership and the public.

The main reason an Agency-wide strategic plan has not been initiated, according to David Waller, is a lack of funding. Preparing a credible, well-considered strategic plan requires a dedicated planning office and months of consultation, meetings and drafting that may distract staff from other duties, thus requiring additional resources. Despite many years of proposals from the Secretariat, the BoG always managed to cut proposed funding for such an office. Being future-oriented rather than serving a current need, it was the most vulnerable to short-term budget cutting in an atmosphere of ZRG. DG Amano is reportedly in favour of developing a strategic plan, and has secured modest resources in the 2012 budget to begin the process.

HUMAN RESOURCES

The 2005 report on the IAEA by the US GAO described "a looming human capital crisis caused by the large number of inspectors and safeguards management personnel expected to retire in the next 5 years" (GAO, 2005). Like nuclear vendors, operators and regulatory agencies, the IAEA is experiencing generational change. Twenty-two percent of its inspectors are due to retire in the next few years[7] and the Secretariat as a whole is facing significant retirements. Even in normal circumstances, the Agency faces stiff competition from industry and national regulatory bodies, which can offer salaries that are more attractive and other benefits. In the current circumstances, it is up against a double hurdle: like industry and regulators, its faces a general worldwide shortage of educated and experienced personnel in the nuclear field at the very time that demand is increasing due to the revival of interest, at least in some quarters, in nuclear energy.

Part of the Agency's dilemma arises from what some have described as dysfunctional personnel rules that work against the formation of a permanent career service. From the time it was established, the Agency took the view that as a "technical" body it should have a constant influx of new professionals in order to stay current with rapid technological advances and that permanent positions should, therefore, be kept to a minimum. In fact, the Statute requires that the Agency "be guided by the principle that its permanent staff shall be kept to a minimum" (IAEA, 1956: Art. VII c). This is in stark contrast to the United Nations, which, following the precedent set by the League of Nations, set up a largely permanent international civil service to protect staff from government pressure and arbitrary dismissal (Weiss, 2010: 51), thereby encouraging "independence" and "impartiality" (Jönsson and Bolin, 1988: 313). By 1998, the IAEA had the lowest percentage of permanent staff in the UN system (Jönsson and Bolin, 1988: 314), but since then, the United Nations as a whole has moved closer to the IAEA model to avoid the dysfunctional aspects of permanent positions (notably the inability to dismiss poor performers).

Currently, about 34 percent of the IAEA's professional staff is on long-term contract (the term "permanent" is no longer in favour).[8] The rest are subject to the so-called "rotation policy." Under this system, new staff constantly rotate through the Agency (the same staff do not rotate in and out, although occasionally they do). Three-year, fixed-term contracts are offered initially; these are extendable, subject to performance, by two two-year increments to five and seven years respectively. After seven years, staff members are usually

7 Presentation by Nobuiho Muroya, Director, Division of Operations C, Department of Safeguards, IAEA, to Wilton Park Conference 1008 on Nuclear Non-Proliferation and the 2010 Review, December 14–18, 2009.

8 According to David Waller, former DDG for Management.

forced to leave. In a small number of cases, due to a continuing programmatic need or due to excellent performance, individuals may be given long-term contracts or have their contracts extended at the DG's behest; in other cases they be given short-term contracts supported by voluntary funds from their state of origin. DG ElBaradei introduced the seven-year rule on the advice of Agency lawyers who took as jurisprudence several cases brought before the International Labour Organization (ILO) during the 1990s (unlike UN specialized agencies, which are subject to the UN Common System of personnel policies, the IAEA is subject to the Administrative Tribunal of the ILO). These appeared to establish approximately seven years as the period beyond which the employer-employee relationship is so well established that there would be an ongoing obligation to maintain the employee in permanent employment. The rule, however, merely formalized a situation that had long existed. The IAEA has recently attenuated the rule somewhat, as new ILO rulings have seemed to suggest that eight or more years would be regarded as indicating a right to permanent employment.

The pros and cons of the IAEA's rotation policy are debatable. In its favour, it, as originally envisaged, permits a turnover in professional staff that can reinvigorate the organization with fresh ideas and enthusiasm. Although nuclear science and engineering are no longer considered cutting-edge, the current revival in interest is producing new technological and engineering developments that the Agency needs to keep abreast of. The system also allows the Agency to remove poor performers, something that other UN organizations, most infamously the UN Secretariat in New York, had traditionally struggled with. Finally, the system results in a constant return of IAEA officials to their countries of origin, resulting in what others have called an "alumni effect," the creation of a valuable network of scientists, technicians and administrators working in the nuclear energy field (Jönsson and Bolin, 1988). As Maurice Strong puts it, "These in-and-outers…all are part of a re-circulation process making nationally sensitive people out of international public servants and internationally sensitive people out of national servants" (1978). Jönsson and Bolin go so far as to say that the fixed-term contract system has placed the Secretariat in a strong position vis-à-vis the Agency's decision-making bodies, especially the BoG, through its creation of an informal nuclear "alumni" community (1988: 321).

On the negative side, the system can result in losses of institutional memory and expertise, and complicates personnel planning and career development. The lack of a likely long-term career path may also deter skilled personnel from joining the Agency in the first place. One incident resulting from the rotation policy often cited as an egregious example of its unintended consequences is that of an experienced Swedish technician at the Seibersdorf Laboratory who was let go, despite his skills being irreplaceable and notwithstanding US government protestations. It appears, however, that such ill-judged decisions are rare. A committee, led by the DG, takes great care to consider all cases subject to the seven-year rule and to grant them permanence if this is in the Agency's best interests.

Political considerations would come into play in any attempt to amend the system. It is popular among developing countries as it ensures turnover in Agency personnel, providing their nationals greater opportunities for gaining international experience while at the same time increasing the likelihood that they will return home afterwards to contribute to their country's often limited talent pool in the nuclear area (Jönsson and Bolin, 1988: 314). Among Western member states, the rotation policy is often the most aggravating aspect of the IAEA's management policies. As one former US State Department official commented to the author, changing the seven-year rule would be the single most important recommendation that this report could make.

On balance the rotation policy appears to serve the interests of the Agency well; however, the Secretariat should seek ways to address the dissatisfaction some of the Agency's key funders have expressed with its unintended consequences. This would include strengthening procedures to ensure that key personnel are not mistakenly dismissed; seeking greater flexibility for the DG in recruiting and retaining critical personnel through financial and other incentives; improving the Agency's succession planning; and speeding up its recruitment processes. The external auditor recommends "a more judicious mix of long- and fixed-term appointments in all Departments, an Agency-wide common approach to long-term staff, at a level higher than 40%, a target of 37% women as minimum (UN average), and a more active use of the tools available to terminate the employment of poorly performing staff" (2011a: 39).

Another complaint about the IAEA's peronnel policies concerns the mandatory retirement age, which is currently 62 years (for a quarter of the Agency's longer-serving staff it is only 60). In the Western world, at least, such requirements are increasingly seen as untenable — leading to a loss of expertise and experience, but also shifting the burden to pension funds. The IAEA mandatory retirement age should be raised to 65.

Other criticisms of the Agency's personnel policies include inadequate recruitment, training and career management. However, succession planning is extremely difficult in an organization that for the most part has no permanent career paths to offer. The Agency's laborious recruitment policies do, nonetheless, make it more difficult than it needs to be to hire needed talent quickly. Replacements often arrive months after positions have become vacant, resulting in a loss of institutional memory and expertise (IAEA, 2008h: 30). Current figures show that the objective of "recruitment in 18 weeks" is still far from being achieved. Currently, this period takes 25 weeks on average, almost 40 percent more than the objective (IAEA, 2011a: 27). The Agency's training programs have also been criticized. Consultants provided free by member states to fill gaps distort proper personnel management. The Commission of Eminent Persons recommended that the Agency adopt a "flexible and transparent personnel system focused on attracting, training and retaining the highly qualified personnel that it needs" (IAEA, 2008h: 31). It proposed the DG be given flexibility to offer attractive terms to specially qualified and

indispensable personnel, including the possibility of higher salaries, career employment and other benefits. The DG should be encouraged to examine the possibilities, presumably in consultation with the ILO. Member states were enjoined by the Commission to help the Agency by establishing programs to attract and train experts to work at the IAEA. At least one, the United States, is already doing this through its Next Generation Safeguards Initiative. States could also provide their nationals with incentives to pursue placements at the Agency, ranging from salary bonuses to career advancement opportunities on their return.

RECOMMENDATIONS

- The Agency should produce an in-house, Agency-wide strategic plan drawing on the precedent set by the Safeguards Department; the requisite funding and resources, including a permanent dedicated planning unit, should be allocated to this task.
- The DG should commission a new, independent, wide-ranging management consultancy review that focuses on how the Agency should tackle the long-standing cultural and other management problems identified by the MANNET report.
- As previously mentioned, a single Deputy Director should be appointed, with other DDGs grouped in a third management tier in order to provide management and policy support to the DG.
- The rotation policy should be retained, as it appears on balance to be beneficial to the Agency, but dealing with its unintended consequences, such as the loss of essential personnel, complicated succession planning and recruitment delays should be addressed.
- The Agency should adopt a more flexible recruitment system to ensure that it attracts and retains top-quality personnel.
- The Secretariat should continue to pursue improvements to planning, management and budgetary processes in all areas of its operations.

IAEA Seibersdorf Laboratory. (IAEA Photo by Dean Calma)

PART EIGHT: TECHNOLOGY AND INFRASTRUCTURE

The IAEA, as a professed science and technology-based organization, is acutely aware that it needs to keep up with technological developments to make its operations as effective and efficient as possible. This has been a struggle during the decades of zero real budgetary growth, although technology has been able to produce savings in some instances, notably in personnel costs, that have permitted the Agency to weather the lean years. Nonetheless, constant budget cuts have left the Agency suffering from gross underinvestment in its facilities and equipment, which is only now being partly rectified. Among the Agency's various programs, technology plays the greatest role in safeguards and verification. Keeping up with the latest advances is crucial to the Agency's non-proliferation mandate since it is in a sense engaged in a "technology race" with potential proliferators who will be seeking the latest technology to advance their aims. IT plays an increasingly vital role in all aspects of the Agency's operations.

There is no shortage of ideas on how new technology might contribute to the Agency's operations. At the Agency's eleventh Symposium on International Safeguards, "Preparing for Future Verification Challenges," held in Vienna in November 2010, scores of papers were presented to 670 participants by Agency staff, science and technology experts, and industry and non-governmental representatives (IAEA, 2010c). The difficulty for the Agency is to select the most appropriate and effective technology at a cost that its member states are willing to bear. This section considers some of the key technology and infrastructure requirements of the IAEA, and the challenges in acquiring and maintaining them.

VERIFICATION TECHNOLOGIES AND INFRASTRUCTURE

Sample Analysis (Environmental and Nuclear Material)

The Agency collects and analyzes both environmental and nuclear material samples as part of safeguards. While the taking of nuclear material samples has been a traditional safeguards tool, ES was first introduced as a safeguards measure in 1996. It is now in routine use and, according to the Agency, "is a powerful tool for detecting undeclared nuclear material at declared facilities or at undeclared locations" (IAEA, 2007a: 24). Thousands of samples in the form of "swipes," the majority from equipment surfaces and buildings, have been collected and analyzed and the resulting data evaluated. A major increase occurred after 2003 due to special verification activities in several states (mostly Iraq, Iran and North Korea). ES is, however, expensive at around $5,000–$10,000 per sample.[1]

The analysis of samples takes place at the SAL at Seibersdorf outside Vienna. The facility is currently undergoing upgrades (see details below). It comprises an Environmental Sample Laboratory and a Nuclear Material Laboratory (including a Clean Laboratory). In addition, the Agency's Rokkasho On-Site Laboratory analyzes samples from the Rokkasho-mura facility in Japan.

Lacking the capacity and latest sophisticated technology for analyzing the full range of nuclear samples, the Agency has, in addition to the SAL, relied on a Network of Analytical Laboratories (NWAL). The NWAL currently comprises 19 laboratories (IAEA, 2011d: 84) in several member states[2] and facilities run by the European Community (EC) and the United Nations. There have been continuing difficulties with this system, partly because it has grown "organically" in an unplanned, ad hoc fashion. There are a variety of facilities with multiple types of contracts with the Agency. The time it takes to produce results has been an ongoing issue. At one stage, it was taking up to three or four months between collection and the reporting of analytical results, clearly far too long for effective verification (and deterrent) purposes. (Three weeks are normally required just to distribute samples to NWAL laboratories (IAEA, 2006i: 3). The Agency's goal is to reduce this to one-and-a-half to two months (still rather long). The Agency reported in 2010 continuing delays in the collection, distribution, analysis and evaluation of ES results (IAEA, 2010d: 11).

Another difficulty is that the Agency pays the laboratories only a fraction of the cost of such analyses and they, in turn, are not always available when needed. Budgetary constraints in member states and changing national priorities can affect the timeliness with which Agency samples are analyzed. States are unwilling to have their expensive laboratories on standby to receive IAEA samples since they need them for their own purposes. Several states have abandoned efforts to have their laboratories accredited to the NWAL since doing so requires advanced technological and logistical infrastructure and a substantial financial commitment.

There has been an ongoing debate between the Secretariat and member states about the extent to which the IAEA should be self-sufficient in its analytical capabilities. Some member states are concerned that the IAEA wants to "empire build." They argue that the network provides both quality control and a backup in case the SAL becomes unavailable.

The recent addition to the NWAL of several new laboratories capable of carrying out bulk analysis to should help reduce the delays in ES. In 2010, a laboratory in Brazil joined, thereby increasing the network's geographical spread (IAEA, 2011d: 84), which is important for both technical and political reasons. Efforts to expand the network for both nuclear material and environmental swipe analysis continue. Additional laboratories in Belgium, China, Finland, France, Hungary, South Korea and the United States are being assessed in terms of their capabilities and capacities or are already at various stages of the qualification process (IAEA, 2011cc: 6).

The analysis of nuclear samples (small amounts of nuclear material such as plutonium and enriched uranium) is more problematic than for environmental samples since they are more radioactive. Heightened security requirements since 9/11 means the Agency has encountered increasing difficulties in shipping samples to outside laboratories. The Agency argues that it needs its own independent capability and that with the proper equipment it could perform all of the nuclear sample analysis.

The Agency has, in the past, had a reasonably sized network for analyzing nuclear materials, but it was underutilized and shrank to just one EC facility. It is currrently being revived by adding reactivated laboratories in the Czech Republic, the Netherlands and Russia, and qualifying new ones in Belgium, France and the United States (Hamilton, 2010). The Agency now needs to send sufficient work to these outside nuclear materials laboratories in order to keep the network active.

Wide area environmental sampling (WAES) involves different sampling collection techniques to ES and according to the Secretariat presents "significant sample and data analysis challenges" (IAEA, 2006h: 14). The term "wide area" means the collection of environmental samples not around a suspect facility or at a specific geographic location, but instead over much larger regions (in the order of hundreds of thousands of square kilometres). In 2006, the Secretariat reported to the BoG's Committee on Safeguards and Verification on a two-year study (conducted from 1996 to 1998) of the utility of WAES to the Agency's detection of undeclared nuclear material and facilities, saying the results were "not encouraging." The study, detailed by a Pacific Northwest Laboratories presentation in 2010, concluded that it would be easier to detect plutonium reprocessing plants than uranium enrichment facilities (due, in part,

1 Unofficial estimate from IAEA sources.

2 Australia, Brazil, France, Japan, Russia, the United Kingdom and the United States.

to the ubiquity of uranium in the natural environment) and that any system would have to rely on other indicators to narrow the sampling area (Wogman, 2010). Establishment of a standing WAES system was also estimated to be prohibitively expensive. The study recommended a small-scale field trial and further studies. In June 2007, DG ElBaradei noted that that there had been no general implementation of WAES due to the projected cost.[3] Further US studies have indicated that the technology is still too expensive for the Agency to deploy a permanent system. In addition, the Agency would be hard-pressed to assemble the necessary expertise to run it.

INFRASTRUCTURE

The Agency has several facilities besides its headquarters at the Vienna International Centre. Among the most important are the SAL and the On-Site Laboratory at Rokkasho mentioned above. In addition, the Agency runs a Marine Environment Laboratory in Monaco. The Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, is a joint enterprise of the IAEA and UNESCO.[4]

The SAL facilities at Seibersdorf were built in the 1970s and require an investment, according to the Agency, of approximately €50 million to "prevent a potential failure in the area, which could put the credibility of IAEA safeguards at risk" (IAEA, 2008a: 27). Former DG ElBaradei argued that being "forced" to use external national laboratories for backup analysis put into question "the whole independence of the agency's verification system" (IAEA, 2008a: 27). He undoubtedly had in mind charges by Iran that laboratories in Western countries would be biased. ElBaradei also complained that environmental sampling equipment at SAL was 28 years old. Most scandalously, the facility was failing to meet the safety and security standards that the Agency encourages its member states to implement.[5] ElBaradei presented a report to the BoG in October 2007 outlining the critical requirements for modernizing the SAL at an estimated cost of €39.2 million through 2008–2010 (IAEA, 2007e). The Commission of Eminent Persons in 2008 called for a one-time increase of €80 million in capital expenditure for, among other things, refurbishing the SAL and adequately funding the Agency's Incident and Emergency Centre (IAEA, 2008h: 30).

Since then, as noted in its *Programme and Budget 2012-2013*, the Agency's "considerable infrastructure requirements have begun to be addressed" (IAEA, 2011b: 3). In April 2009, the BoG established a Major Capital Investment Fund (MCIF) for capital investment and infrastructure renewal. Given the paucity of contributions, however, there has been no accumulation of funds. Meeting the Agency's capital expenditure needs is therefore contingent on extra-budgetary contributions from member states each year. For 2012, the Agency estimates its major capital investment requirements will total €54.7 million, of which over 50 percent — €28.3 million — currently remains unfunded either from the Major Capital Investment Fund, the regular budget or assured extra-budgetary contributions.

A major capital expenditure item is what is now called the Enhancing Capabilities of the Safeguards Analytical Services (ECAS) project at Seibersdorf (IAEA, 2011b: 41). This includes an extension to the Clean Laboratory to accommodate a large geometry secondary ion mass spectrometer (LG-SIMS) and building a new Nuclear Material Laboratory to replace an aged facility dating back to 1976. The overall financial needs for the project are now €65.9 million, a €21.7 million increase over the 2010 estimate. The increase results from the revised scope of the project and higher cost estimates. The main changes result from the need to upgrade safety and security at the facility (obviously important, not least as a demonstration to member states), mysterious "infrastructure needs," transition and licensing costs, equipment, and office/training space, as well as project management and coordination. The project also includes obtaining modern equipment, notably an expensive (€2.5 million) multi-collector inductively coupled plasma mass spectrometer. In the Agency's assessment, if ECAS fails to achieve the necessary funding, there is a continuing risk that the IAEA's independent analytical capabilities will be compromised (IAEA, 2011b: 44).

Extension of the Clean Laboratory was completed in 2011 and the LG-SIMs were installed (IAEA, 2011d: 86). In September 2011, ground was broken for the new Nuclear Material Laboratory, which will consolidate activities that were spread over several parts of the Seibersdorf site and provide the Agency with a modern and expandable capability for nuclear sample analysis collected from all points along the nuclear fuel cycle (Amano, 2011a). The new facility is expected to be completed in 2014. Currently, two-thirds of the total of €65.9 million for the complete ECAS project has not been secured (Amano, 2011a). This is undoubtedly a gnawing concern for those in the Agency involved in implementing the project.

Some member states, and some individuals within the Secretariat, have been critical of the way that the Agency is attempting to manage the enormous ECAS project by itself. They argue that the Agency is not capable of managing large infrastructure development projects and that it should have considered outsourcing it. Professional help can be expensive, however, and does not necessarily eliminate risk, as many governments have discovered. There has also been concern that by buying top-of-the-range, state-of-the-art equipment, the IAEA is "Rolls-Roycing" the SAL. It has been suggested that the Agency should only buy the equipment it needs now, not equipment that risks being outmoded by the pace of technological change. Moreover, it is argued that under the new safeguards regime the laboratory may be required to do fewer operations, not more.[6]

3 Quoted in Borger (2007).

4 Administration is carried out by UNESCO on behalf of both organizations.

5 The external auditor had since 2004 complained that Seibersdorf did not have a security fence that completely enclosed the facility; that there were weak controls to prevent access to the premises by non-IAEA staff; and that parking lots immediately adjacent to the SAL meant the facility was vulnerable to car bombs that could damage or destroy the laboratory. It took five years for the fence to be built. As of the 2010 audit the other two issues had not been addressed satisfactorily (IAEA, 2011a: 40).

6 It is also argued that there needs to be front-end preparation of samples to avoid the overuse of the new SIMS machine, which is expensive to operate.

SATELLITE IMAGERY

The Secretariat has utilized information from high-resolution, commercial satellite-based sensors to improve its ability to monitor nuclear sites and facilities worldwide, since 2002. Typically this is in the form of high-resolution (up to 0.61 metres) optical images; multi-spectral images (resolution of 2.44 to 30 metres); synthetic aperture radar imagery (resolution of 10 metres); thermal imagery (resolution of 60 to 90 metres) and experimental hyperspectral imagery (resolution of 30 metres) (IAEA, 2006b: 2). By June 2011, imagery was being acquired from 32 different Earth observation satellites (an increase of 10 since 2010). Contacts were being established with new imagery providers to diversify sources and ensure the integrity and authenticity of satellite imagery (IAEA, 2011cc: 5). The Agency uses imagery primarily in planning and implementing verification activities in the field. Since 2010, over 160 imagery analysis reports, including several new imagery-derived geospatial products,[7] have been produced (IAEA, 2011cc: 5).

Analysis is performed by the Satellite Imagery Analysis Unit (SIAU), comprising around 15–20 imagery analysts supported by other professional staff members. The Agency notes openly that the unit's capabilities are circumscribed by financial constraints and by the availability of personnel (IAEA, 2006b: 2). In addition, the Agency's capabilities are restricted by the:

- limited ability to identify observable signatures for small-scale and/or low profile nuclear facilities;
- limited availability of relevant satellite images for analyzing past and present nuclear activities;
- limited ability to acquire contemporaneous satellite images in a timely manner; and
- lack of automated tools for verifying routine declarations of states and for change detection.

To enhance its use of satellite imagery, the Agency needs access to higher resolution optical imagery (less than 0.5 metres). There are continuing restrictions in most member states that prevent Agency access to such imagery. The Agency would also benefit from access to satellite data not currently available commercially, including hyper-spectral libraries and regional and local meteorological data.[8] Access to non-commercial thermal imagery would also enhance the Agency's ability to detect undeclared nuclear facilities and activities (since such facilities emit heat when operating). Finally, in special cases, presumably in possible or actual cases of non-compliance, the Agency needs to be able to obtain satellite imagery more quickly.

The Agency has proposed that member states: grant the Agency increased access to imagery, including to sensor programming and scheduling so that it may better target imagery requests; provide more specialized training to Agency staff in satellite imagery analysis (especially thermal and hyper-spectral); and explore with the Secretariat the possibility of direct acquisition of satellite imagery from ground stations (IAEA, 2006i: 5).[9] These are all clearly sensitive areas for the states (in the past, for example, the US government has barred American companies from supplying satellite photos of Israel to international agencies).[10] Some member states have been providing more assistance in this area and the Agency's capabilities are gradually improving. If member states are serious about empowering the IAEA to detect undeclared nuclear programs, they will have to supply the requisite technological means to the Agency.

REMOTE MONITORING

The Agency is continuing to install remote monitoring equipment at nuclear facilities under safeguards. In 2010, there were 258 safeguards systems with remote monitoring at 102 facilities in 19 states (as well as Taiwan). These systems include surveillance equipment such as cameras and unattended monitoring devices. The purpose of moving to these systems is not only to enhance verification, but also to permit the scaling back of on-site inspection by humans, thereby saving money and permitting human resources to be devoted to other tasks, including analysis at headquarters. The Agency admits that inspection effort savings are difficult to quantify because remote systems have become such an integral part of safeguards approaches. Nonetheless, it estimates that approximately 277 person days of inspection were saved as a result of remote monitoring in 2010 (IAEA, 2011d: 83). Person days in the field[11] in fact dropped from 15,000 in 2007 to 13,500 in 2010 (IAEA, 2011z: 4, 7, 9-10). While the amount of material under safeguards is rising, the number of days in the field is falling. There has been some criticism in the past that the Agency was moving too quickly to install sometimes-unreliable remote monitoring systems as a way of saving money. The reliability of such systems is, however, improving and the cost is falling, making them irresistible as safeguards tools (IAEA, 2007a: 19).[12]

7 Geospatial data combines imagery and geographic information.

8 It is not clear why the IAEA could not cooperate with the WMO in this respect.

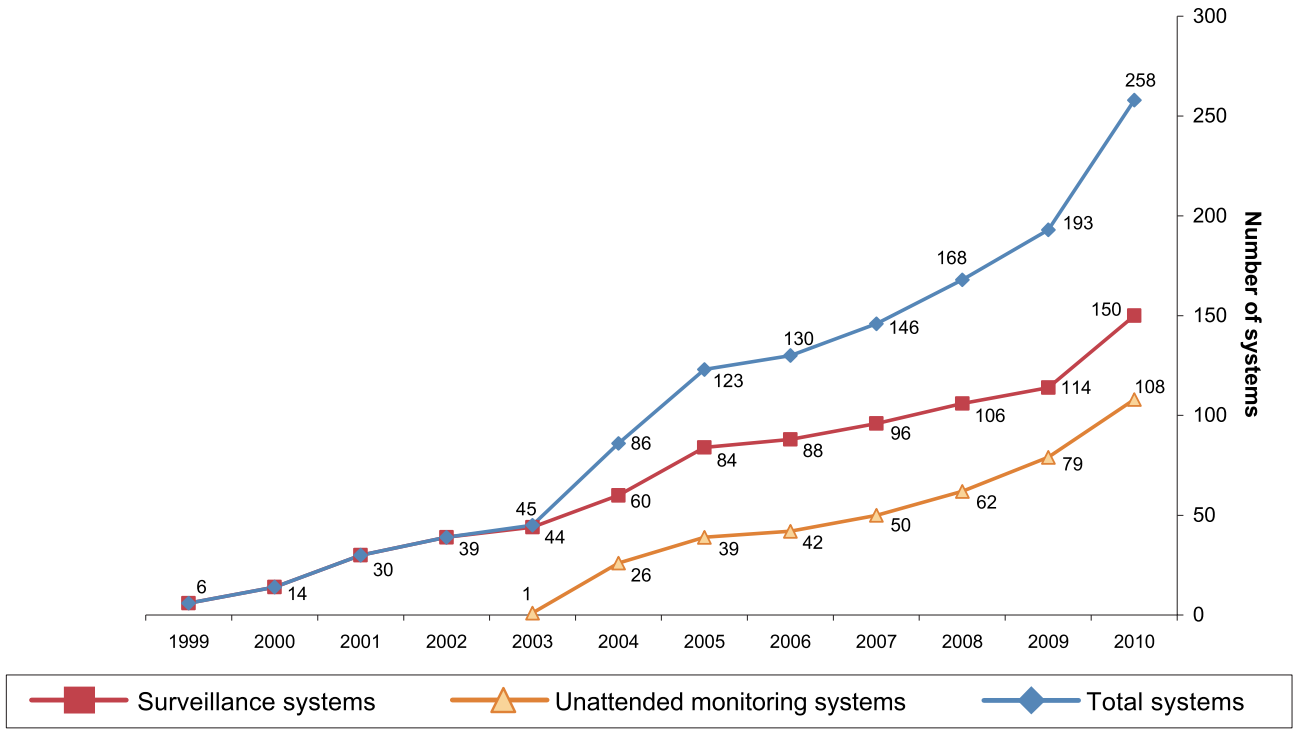
9 The Secretariat made six additional specific recommendations to the BoG Advisory Committee on Safeguards and Verification in April 2006. See IAEA (2006b). "Enhancing IAEA Satellite Imagery Capabilities: Note by the Secretariat." Note 24: 3-5.

10 The 1997 National Defense Authorization Act included the Kyl-Bingaman Amendment, banning US companies from providing satellite photos of Israeli territory that were more precise than those already widely available. See www.nesdis.noaa.gov/CRSRA/licenseHome.html.

11 Known as calendar day in the field for verification, these are calendar days spent in performing inspections or complementary access, design information verification, inspection travel and rest periods.

12 The Agency claims, seemingly counterintuitively, that digital equipment is more expensive and has a shorter lifespan than analog equipment.

Figure 8: Number of Remote Monitoring Systems in Use, 1999–2010



Source: IAEA (2011d: 35).

The Agency has announced that all safeguards data from the Rokkasho Reprocessing Plant in Japan is now remotely transferred to the Agency's headquarters on a daily basis through 26 surveillance and unattended monitoring systems (IAEA, 2011d: 83). An advanced system for remotely monitoring fuel transfers at on-load reactors was also installed at several facilities in 2010; this is expected to significantly reduce the need for on-site inspector presence when the transfers recommence in 2011. In addition, the Agency reported that the total number of electronic seals (which can only be removed with an electronic password and transmit data on their status to Vienna) increased to 147 in 2010, including 89 of the new electro-optical sealing type (IAEA, 2011d: 84).

The most significant recent development affecting the Agency is perhaps the successful conclusion in 2010 of a six-month pilot project jointly conducted with the European Space Agency to establish the feasibility of secure satellite communications for safeguards data transmission (IAEA, 2011d: 83-84). Demonstration equipment was set up in Armenia, Hungary and Ukraine with links to a communications hub at IAEA headquarters. As a result of the study, the Agency has decided to establish operational remote monitoring connections with facilities in Armenia, Belarus, Kazakhstan and Ukraine (five sites including Chernobyl) (Mancini, 2011). The handover of the system at minimal cost to the Agency means that it now has at its disposal a fully secure, self-supported satellite network capable of global coverage. The IAEA has lagged considerably behind the CTBTO in acquiring such a capability: that organization's Global Communications Infrastructure has been transmitting nuclear test monitoring data to Vienna from its International Monitoring System on a near real-time basis since 1998 (CTBTO, 2002).

SAFEGUARDS RESEARCH AND DEVELOPMENT, INCLUDING NOVEL TECHNOLOGIES

The IAEA is aware that emerging new technologies may improve the effectiveness and efficiency of safeguards, perhaps dramatically. Several states are active in pursuing safeguards research and development (R&D) for their own purposes and on behalf of the IAEA through their MSSPs. With its limited funds, the Agency could not pursue safeguards R&D without MSSPs.[13] There have, however, been difficulties in the past with member states seeking to foist technology they had developed on the Secretariat, whether it was appropriate or not. Steps have been taken to alleviate this problem through a targeted list of R&D priorities. In turn, the Secretariat has

13 Currently, the following states have such programs: Argentina, Australia, Belgium, Brazil, Canada, China, Czech Republic, European Commission, Finland, France, Germany, Hungary, Japan, Republic of Korea, Netherlands, Russia, South Africa, Spain, Sweden, the United Kingdom and the United States.

been criticized for taking too long to decide on the introduction of new technology, subjecting it to "death by committee," leaving the potential provider disillusioned. An effort has been made to reform this system. Whereas proposals used to go to different committees for consideration depending on the type of technology involved, there is now a Safeguards Strategy and Policy Subcommittee that looks at all R&D proposals.

A major priority, as previously mentioned, is the search for technologies that will detect undeclared materials, facilities and activities — the Holy Grail of verification. The Agency has, for some time, been investigating methods for detecting uranium hexafluoride gas (UF6) for instance, which is used in centrifuges. Yet it was clear that a more systematic approach was required. In 2005, at the behest of the GC, the Secretariat established a project on Novel Techniques and Instruments for Detection of Undeclared Nuclear Facilities, Material, and Activities (known as the Novel Technologies Project) (Khlebnikov, Parise and Whichello, 2008). As well as improving current detection capabilities it was designed to pursue R&D of novel technologies for undeclared activities, including by utilizing MSSPs and internal resources and expertise. After a call was put out to member states, over 60 proposals, covering a wide range of techniques, were received and reviewed by the Safeguards Department. Those regarded as "new" — for which the methodology was already understood and implemented for safeguards — were forwarded to the relevant unit in the Agency for further consideration. Among the novel methods or instruments — those not previously applied by the Agency — four key ones were selected for further development and evaluation within the Novel Technologies Project:

- optically stimulated luminescence for determining if an undeclared location has been used previously for storing radiological material;
- laser-induced breakdown spectroscopy to determine the nature and history of compounds and elements found on site;
- light detection and ranging (LIDAR) to detect the presence and nature of nuclear fuel cycle process activities at suspected locations; and
- sampling and analysis of atmospheric gases to detect the presence and nature of nuclear fuel cycle process activities at suspected locations.

In addition, the project has convened expert meetings on techniques for the verification of enrichment activities; noble gas sampling and analysis; and laser spectrometry techniques. A secure technical database has been established to handle the large volumes of technical data involved.

The R&D Program for Nuclear Verification for 2010-2011 contains 24 projects (IAEA, 2011cc: 4). As of June 2011, 21 MSSPs were supporting over 300 individual tasks within these projects, valued at over €20 million per year. The tasks address issues such as safeguards concepts and approaches; verification techniques and instruments; information collection, processing and analysis; quality management; and training. The Agency cooperates with other safeguards R&D organizations such as the European Safeguards Research and Development Association and the Institute of Nuclear Materials Management.

It is essential that the IAEA continues to pursue technical and technological advances in this manner and keeps track of scientific developments that may assist in verification, especially since serendipitous discoveries that may potentially be powerful verification tools are possible. For instance, scientists in June 2011 alerted the CTBTO to their discovery that perturbations in Global Positioning System signals could indicate the detonation of underground nuclear tests (Park, Grejner-Brzezinska et al., 2011).

INFORMATION TECHNOLOGY

It has been widely recognized for years by member states and the Agency itself that the IAEA's IT management needs to be brought into the twenty-first century. Doing so will require significant continuing investment in both technology and personnel. The Agency's various departments have traditionally managed information in different ways and their systems were often incompatible. The demands of information-driven safeguards and RBM rendered this situation completely unacceptable.

The response has been a major attempt at overhaul in the form of the AIPS. As scheduled, so-called Plateau 1 of AIPS went live in January 2011, representing a major milestone in the Agency's management reform (IAEA, 2011d: 4). This permitted the retirement of several existing legacy information systems. The Agency claims that with the automation and business process re-engineering introduced by AIPs, clerical and secretarial tasks will be reduced, "clearances will follow the workflow of the software" and there will be an increasingly paperless environment. The Secretariat envisages that a "broader number of services" will be put online both in-house and for member states. It is expected that all "plateaus" will be implemented by the end of by 2012. The concept of "one project — one manager" is one useful management reform that is occurring as a result of AIPS (IAEA, 2011b: 151).

THE IAEA WEBSITE

The Agency's website (www.iaea.org), which is designed and managed in-house, should be, in this electronic age, the Agency's main "window on the world" — its most important platform for presenting itself and its accomplishments to all of its stakeholders, including the media and the global public. It should be accessible, current and informative about all of its activities, both past and present. It should also be a key tool for member states, especially smaller ones that have tiny diplomatic missions with no nuclear expertise and little time to wade through complex paper documentation or to meet personally with IAEA experts.

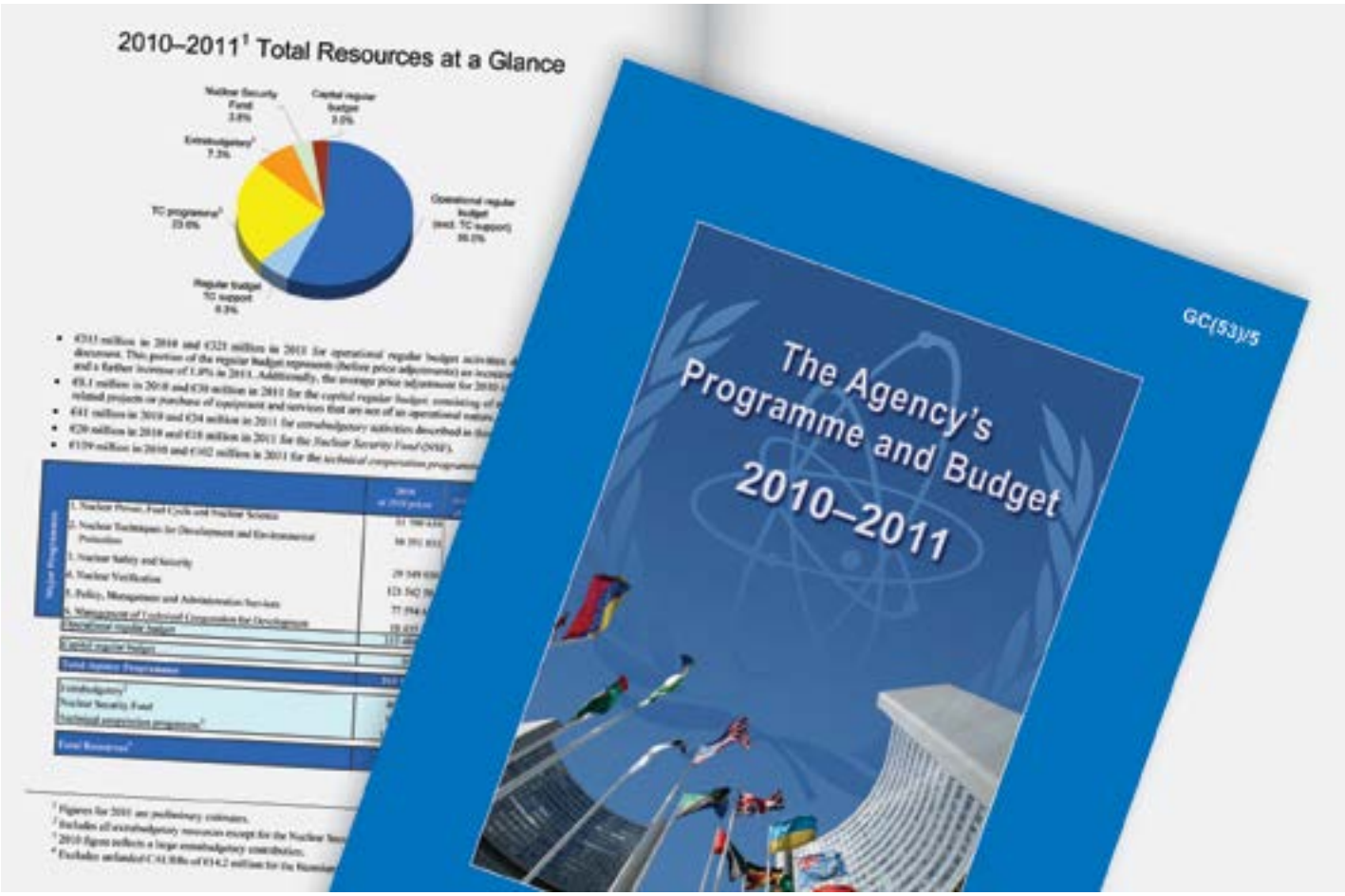
Analysis by CIGI's Digital Media Team concludes that, for a large, bureaucratic organization, the IAEA makes an admirable attempt to package its website's complex content in interesting ways.[14] Its photo features, "Topics in Focus" section, and its pairing of images with written content are assessed as being "compelling." The various social media alternatives are all well represented, including: YouTube, Flickr, Facebook and Twitter. In general, the design allows content to come to the fore; the different programmatic areas of the organization are apparent and easy to find, as are the mandate, upcoming events, news and publications. Novel features are quickly developed when the need arises, an example being the Draft Nuclear Safety Action Plan Dashboard, which is, in theory, an innovative way of displaying basic information and tracking progress on the plan's implementation.

On the negative side, parts of the site are often left out of date for months, including treaty status charts, programmatic details, and raw facts and figures such as the number of safety and security assistance missions conducted by the Agency. While the Dashboard appears to promise "updates" on progress in implementing the Safety Action Plan, no such updates had been entered almost eight months later. It is difficult, if not impossible, to learn how many personnel are employed in each part of the Agency, how many analytical laboratories are accredited to it, which member states have not paid their dues and which states have been granted integrated safeguards status. According to the CIGI team, the ImageBank sign-up and photo download process is confusing and difficult to navigate. The NUCLEUS (http://nucleus.iaea.org/Home/index.html) suite of features was also perplexing: while impressive in scope and size, it seems to host other websites under the NUCLEUS umbrella, making it unclear what is IAEA endorsed material and what is not. NUCLEUS would be better integrated into the IAEA website proper. Inconsistency is also prevalent in other areas of the site — while the primary and secondary pages function well, the design and layout seems to degrade in the tertiary level and below. Even recent key documents such as reports on Fukushima, BoG documents and annual reports can be difficult to locate quickly. For researchers, including historians, the historic material is (as in the case of many venerable institutions' websites) patchy and inconsistently presented. Clearly, more resources need to be devoted to redesigning the IAEA website and keeping it current and cutting-edge.

14 The assessment was done without a significant qualitative evaluation of the content of the IAEA website, but comes from general impressions and comparisons with other large-scale, non-commercial websites.

RECOMMENDATIONS

- The Secretariat should continue to pursue upgrading of the Seibersdorf facilities as a matter of priority and member states should provide the necessary funding to finalize the project on schedule.
- The Agency should continue to seek new technologies for improving safeguards, in particular for detecting undeclared activities; member states should expand their MSSPs accordingly.
- Member states should provide the Agency with more access to satellite-derived data and detection technologies.
- The Secretariat should continue to pursue improvements in IT and other electronic means not only for its substantive work on safeguards, safety and security but also to make its own operations as effective and efficient as possible.
- Remote monitoring as a means of enhancing safeguards inspections should be pursued, bearing in mind that human inspectors are the most proficient in detecting unexpected anomalies.
- The Secretariat should redesign the Agency's website and ensure it is kept up-to-date and cutting-edge.



IAEA Programme and Budget 2010-2011.

PART NINE: FINANCE AND BUDGET

Although the IAEA has traditionally been viewed as one of the most effective and efficient international organizations, it has also widely come to be seen as underfunded, considering the vital roles it is mandated to play, not least in enhancing international security. Comparisons with other UN agencies, with their vastly different mandates and resource requirements, are not, however tempting, especially illuminating. The Agency's regular budget for 2012 of €331.5 million (IAEA, 2011c: iii) is dwarfed by some UN agencies, such as the World Bank's US$3.1 billion for 2011, but is higher than others, such as the 2010 World Trade Organization budget of US$194 million. Many UN agencies have large budgets for development assistance, loans or grants, which the IAEA does not have. This has not stopped the external auditor, the vice-president of the German Federal Court of Audit, Norbert Hauser, expressing the quirky view that "Even though the Agency's general internal and external image is still that of the 'Nuclear Watchdog,' it spends more than half its budget on Official Development Assistance, thus promoting the economic development and welfare of developing countries. Accordingly the Agency should consider itself to be a development organization and act as such" (IAEA, 2011a: 30).

A more fruitful exercise is to consider whether the IAEA budget is sufficient to ensure its effectiveness in fulfilling all of its various mandates. While it is not possible in a report of this nature to comprehensively assess the cost-effectiveness of the Agency as a whole, or even of some of its components, the following critical questions will be considered: whether the expectations of the Agency and its expanding roles are adequately funded; whether the Agency should continue to be financed through a mix of assessed and voluntary contributions; whether the current modified assessed contributions system is equitable and appropriate; whether the Gordian knot between technical cooperation and verification can and/or should be broken; and whether alternative funding sources can be tapped.[1]

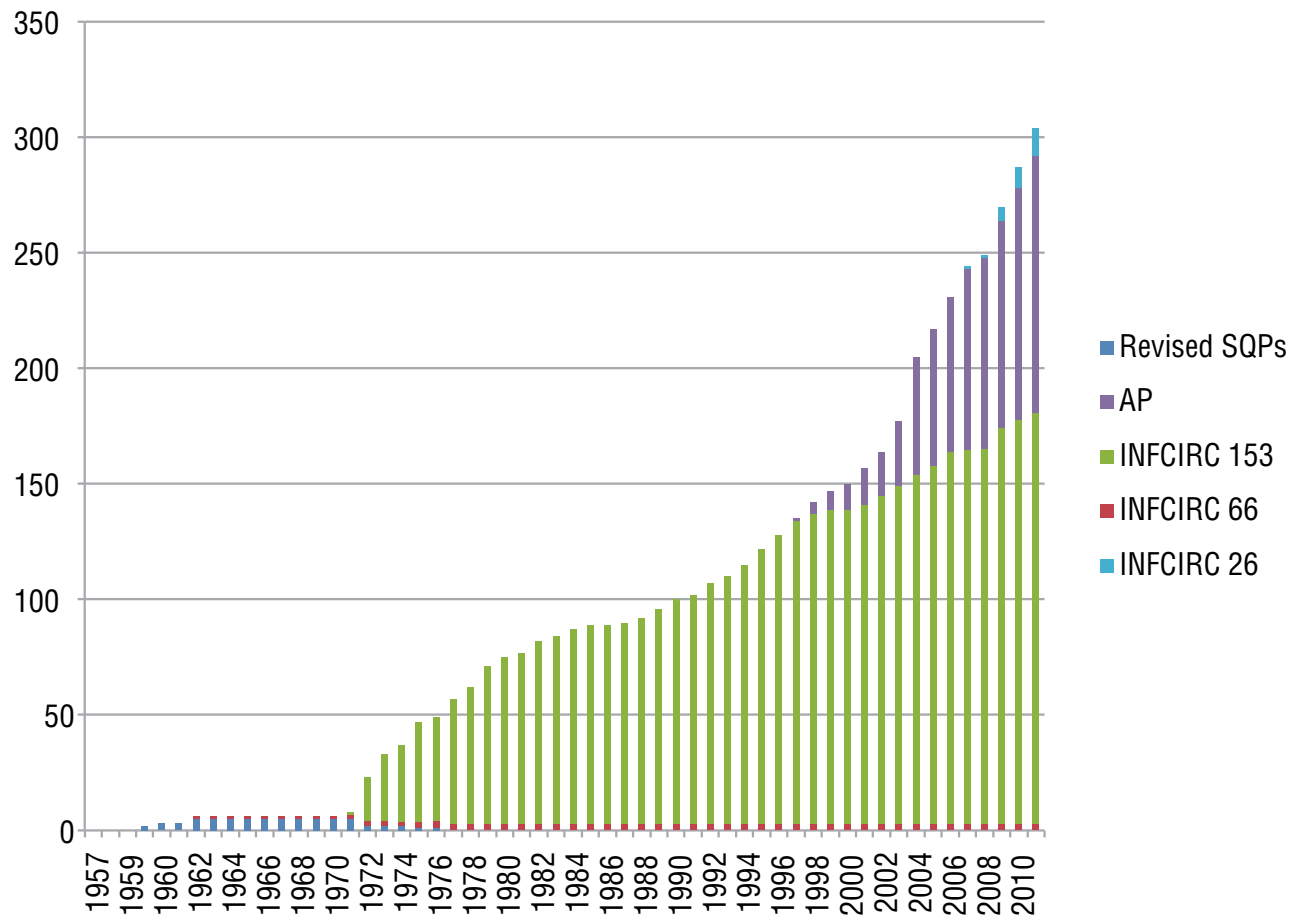
1 Parts of this section are based on research by Justin Alger, who also prepared some of the charts included.

EXPANDING ROLES

There are several factors at play in determining the Agency's current financial situation. The first is the outcome of success: the Agency's traditional roles have expanded significantly, while at the same time, it has been asked to take on complex new roles. As the number of states increased with the end of the Cold War, as a result of the break-up of the Soviet Union and Yugoslavia, so did the Agency's membership. This led to more states entering into safeguards agreements, increasing the verification tasks accordingly. Strengthened safeguards and the AP have increased verification costs considerably, despite some savings through Integrated Safeguards and other efficiencies. The Agency has also been involved in expensive, unanticipated one-off verification exercises in South Africa, Iraq, North Korea, Libya and Iran.[2]

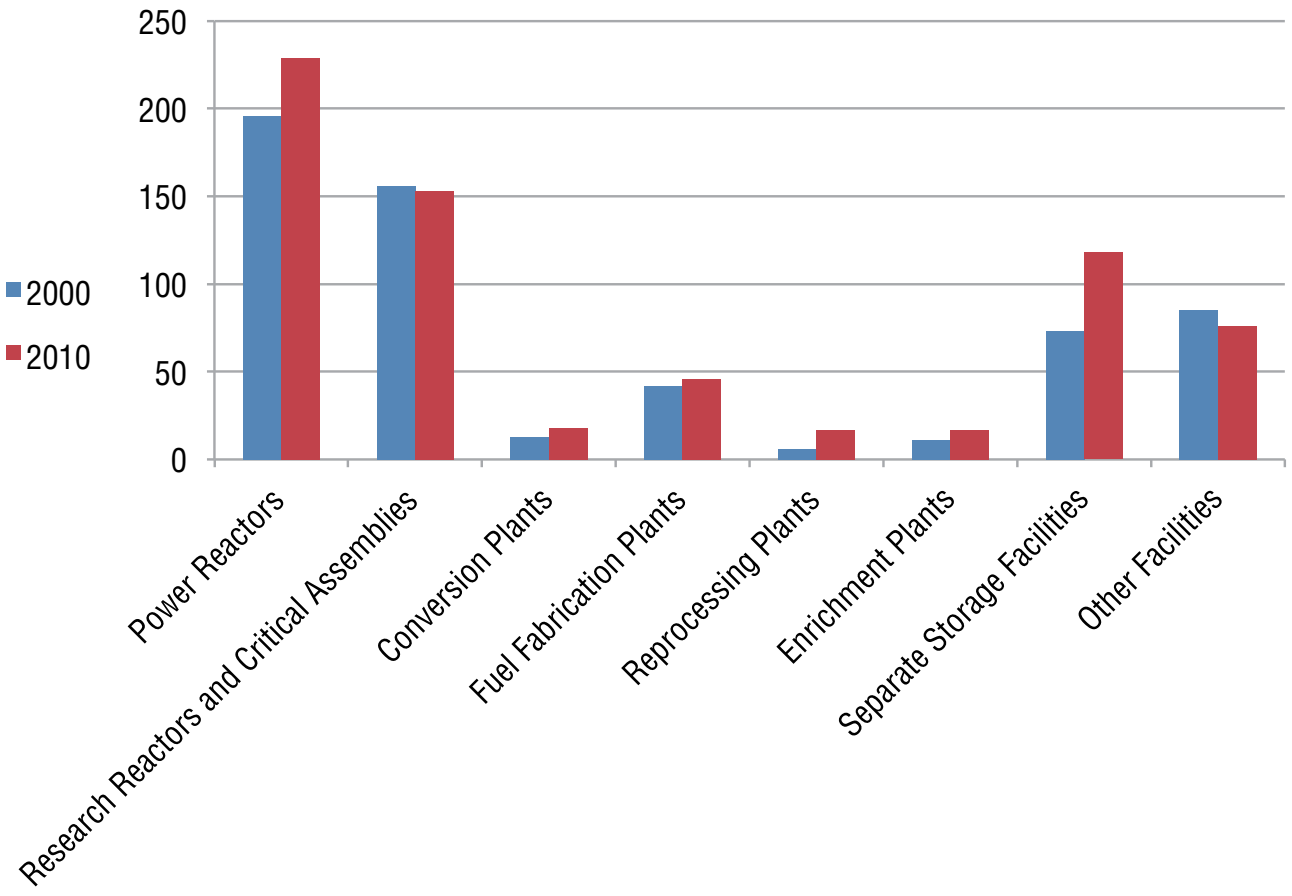
2 The cost of special verification activities in North Korea was €1.9 million; in Iran €3.1 million in 2009; and in Syria €750,000 in 2009 (IAEA, "Estimation of the Cost of Safeguards by State: Note by the Secretariat," 2009/Note 60; IAEA, Safeguards Implementation Report 2009, GOV/2010/25).

Figure 9: Growth of IAEA Safeguards Commitments, 1957–2011



Sources: Data gathered from IAEA Office of Legal Affairs. "Country Factsheets" (available at: http://ola.iaea.org/factSheets/default.asp) and IAEA (2011z).

Figure 10: Facilities Under IAEA Safeguards, 2000 and 2010



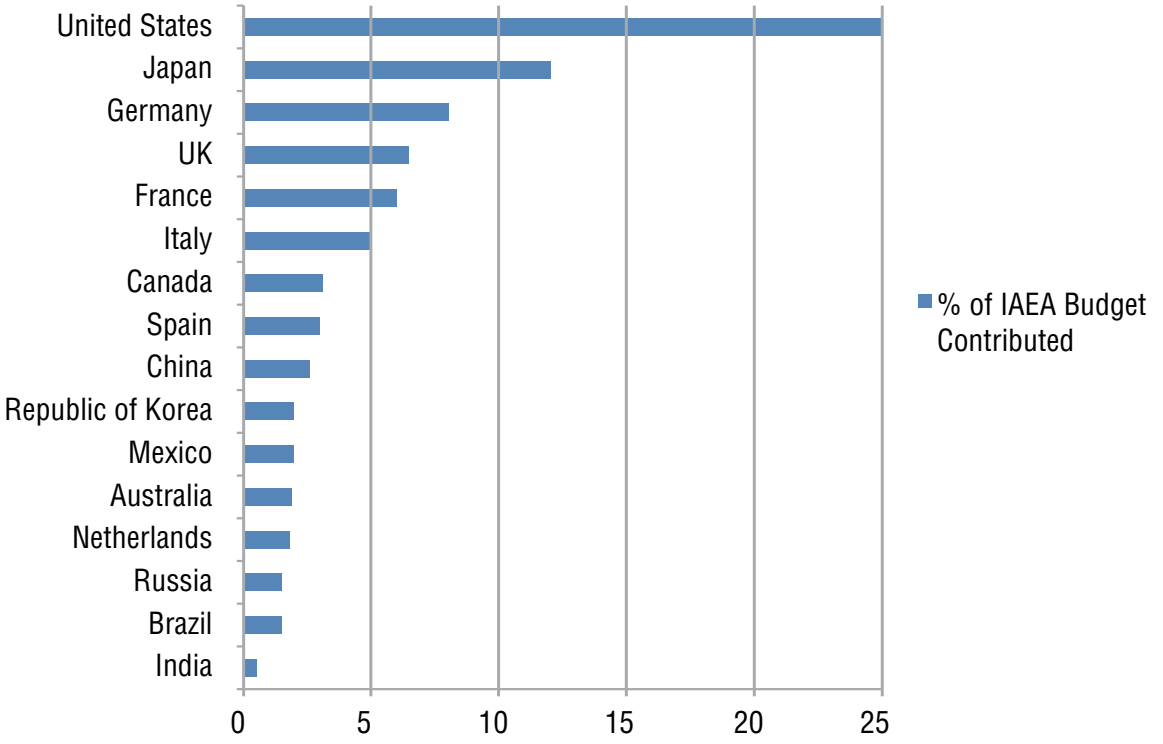
Source: Data extracted from IAEA (2001c: 142) and IAEA (2011d: 102).

Table 3: Approximate Quantities of Material Subject to Agency Safeguards (in SQs), 2000 and 2010

Nuclear Material	2000	2010	% Change
Plutonium contained in irradiated fuel and in fuel elements in reactor cores	81,700	132,505	+62%
Separated plutonium outside reactor cores	9,031	11,881	+32%
HEU (equal to or greater than 20% 235 U)	604	232	-62%
LEU (less than 20% 235 U)	13,204	16,955	+28%
Source material (natural or depleted uranium and thorium)	6,990	10,589	+51%
Non-nuclear material			
Heavy water	25	441.7	+1667%

Source: Data compiled from *IAEA Annual Report 2000,* p. 141; *IAEA Annual Report 2010,* p. 101.

Figure 11: Top 10 Contributors to IAEA Budget and Selected Others to IAEA Budget (2011)



Source: Data retrieved from IAEA (2011ff).

The Agency's role in nuclear safety and security has, as previously outlined, expanded in response to various crises and the emergence of new treaty commitments, as has its involvement in tracking illicit nuclear trafficking and nuclear imports and exports. One silver lining for the Agency was that from the 1980s to the turn of the century the expected growth in the use of nuclear energy in NNWS failed to occur, with only a small number of additional nuclear power plants requiring safeguards. Since about 2000, a revival of interest by many member states in acquiring civilian nuclear energy has created increased demand for the IAEA's technical and advisory services. The Agency is also expected to participate in helping to ensure that new generations of power reactors and associated facilities are designed to be safe and secure and safeguards friendly. Demand for TC, on the other hand, has constantly risen since the IAEA's inception to the point where it regularly outstrips the ability of the Agency to fund all approved projects.

THE IMPACT OF ZERO REAL GROWTH

A second major factor in determining the Agency's financial situation is that like all other organizations in the UN "family," it has been, for the most part, subject to ZRG since 1985. ZRG means no growth in the budget beyond that needed to compensate for inflation. This policy was imposed on the United Nations at the behest of Western countries in an effort to stem the ever-upward growth of budgets, and improve the efficiency of the UN system across the board. But ZRG has become a seemingly permanent part of the UN budgetary landscape.

It is difficult to assess the precise impact of ZRG on the IAEA. Seen by some member states, especially the Western and Latin American states, as useful in forcing the Agency to order its priorities and seek efficiencies, ZRG has certainly made the Secretariat "leaner" and perhaps "meaner." In general, blanket financial constraints like ZRG are, however, a "blunt instrument" (Campbell, M. et al., 2002: 25) for achieving effectiveness and efficiency, as they may simply induce an organization to cut all its activities across the board without changing its priorities in the slightest. This appears to have happened in the case of the Agency, which has been traditionally poor at setting priorities among the multitude of tasks that its member states foist onto it. In any event, it has long since become apparent that ZRG has begun to threaten the Agency's ability to carry out critical parts of its mandate, in part due to chronic underinvestment over many years in infrastructure, technology and human resources. The Agency's verification failures, for instance, may be attributed, at least in part, to its lack of the proper technological capabilities for detecting undeclared nuclear weapons programs.

WHO PAYS FOR THE IAEA?

The major funder of the IAEA is the United States, with over 25 percent of the regular budget and the TC budget, and a considerable percentage of the voluntary contributions and cost-free experts as well. In 2010, this amounted to €135,078,167 (IAEA, 2011b: 104). In addition, the United States provides generous in-kind support to the Agency's goals through its MSSP and NGSI and other programs.[3] The other top funders are listed in Figure 11. States with major nuclear industries that are not major funders are Brazil, China, India, Iran, Israel and Pakistan. Unfortunately, none of the new members that joined the Agency following the end of the Cold War were large or wealthy enough to bring significant new resources to the Agency. Indeed, the break-up of the Soviet Union left its successor state, the Russian Federation, unable to pay its dues for a year, while the successor states to the former Yugoslavia have still to settle its debts to the Agency.

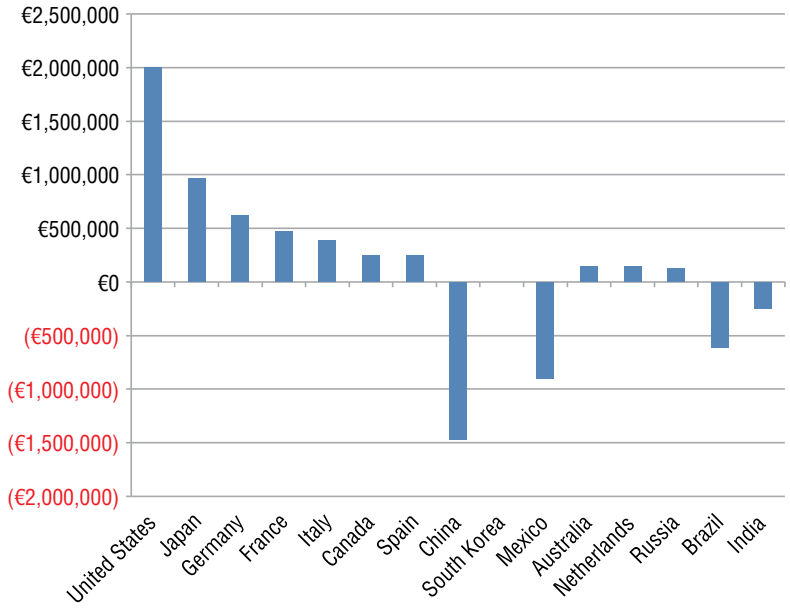
The IAEA, along with all other UN agencies, uses the UN Assessed Contribution system, which calculates the contribution percentage of each state based on its Gross National Product (GNP). However, under the UN system, the least developed countries are given a substantial discount by paying a low fixed amount, regardless of their GNP (in the IAEA case, this amounts to around €2,500 for states like Afghanistan, Congo and Palau).

The sharp rise in safeguards costs as the NPT was implemented after 1970 produced complaints from the developing countries that they were paying for safeguards for an enterprise, the civilian nuclear industry, that mostly belonged to the developed world. The BoG, therefore, decided that assessments for non-safeguards activities would be made according to the standard UN scale, while for safeguards a "shielded list" of states with less than one-third the average per capita GNP of the 10 richest members, would pay nothing (IAEA, 1972b). Minor changes were made to the criteria in 1976, 1977 and 1980, to adjust for an expanding membership and for "some abnormalities," (IAEA, 1976; IAEA, 1977; IAEA, 1980) such as the near bankruptcy of the Soviet Union in 1979 (Fischer, 1997: 303). On balance, the system worked well in protecting the poorer developing countries, while ensuring adequate funding for safeguards.

Ironically though, it was the larger developing countries, such as Brazil, China and Mexico, that have received the greatest benefit from shielding, not the smallest. The United States, on the other hand, has borne the brunt of the additional burden as its base rate grew from 25 percent to 25.6 percent — a considerable amount in real terms. The figure below shows the total euro amount that select states pay in 2011 above or below their contribution had the normal UN assessment scale been used.

3 See National Nuclear Security Administration (2010). "National Nuclear Security Administration Contributions to the IAEA." Fact Sheet. Available at: www.nnsa.energy.gov/mediaroom/factsheets/factsheet201009 and US Department of State (2012). "The IAEA Peaceful Uses Initiative and the NPT." Fact Sheet. Available at: www.state.gov/t/isn/rls/fs/187506.htm.

Figure 12: Difference between Scaled and Unscaled Contributions to 2011 Regular Budget



Source: Adapted from IAEA (2011ff).

In the 1990s, the tide began turning against the shielding arrangement as increasing numbers of states came under safeguards and some of the developing states became wealthier and, therefore, more able to share the financial burden. In 1995, the BoG began moves "to arrive at long-term arrangements for the financing of safeguards" that would be "permanent and cost-effective" (IAEA, 1995; IAEA, 2000b). The contribution of shielded states was gradually increased until 2003, when the complete phasing out of the system began (IAEA, 2000b).[4] At the current rate, however, the shielding system will not be gone entirely until 2034. It would be better to end it in one fell swoop to regularize the situation, especially as the poorest states would retain their usual UN discount to protect them from dramatic rises in their assessed contributions.

LATE PAYMENTS AND NON-PAYMENTS

A greater impact on the cash flow of the Agency comes not from the declining shielding system, but from the late payments by some member states. In 2010, the Agency experienced a shortfall of income over expenditure of €2.2 million due to non-payment of assessed contributions (IAEA, 2011a: 21). This is due to a variety of factors: fiscal years that differ significantly from the Agency's; the late passage of budgets by national legislatures; and economic difficulties that member states find themselves in from time to time. Others simply plead continuing poverty. The United States is the most problematic, since it provides such a large proportion of the Agency's funding. Although IAEA annual assessed contributions are due on January 1 of each year, the United States delays its payment at least eight months, until October 1 of the following US fiscal year (OTA, 1995: 8). This was done by the US Congress to achieve a one-time reduction in the US annual federal budget. To reverse this would now require two annual payments in one year. In the current US budgetary climate, especially with Republican control of the House of Representatives, it is more unlikely than ever that the US administration would be able to enact such a change.

Many other states, mostly the poorer developed ones, fail to pay their dues on time (or at all), but collectively, their impact is much smaller. If a member state fails to pay its assessed contribution for three years in a row, it is liable to lose its vote in the GC (IAEA, 1956: Art. XIII and XIV). According to the external auditor, in 2010 (the most recent IAEA financial year to have been audited) the level of outstanding assessed contributions increased by roughly €7.7 million to a total of more than €37 million (IAEA, 2011a). Some member states (Mexico, Nepal and Sierra Leone) paid off past debts, but one unnamed member state increased its debts in 2010 to more than €10 million. As mentioned, a continuing issue is the failure of the successor states to the former Federal Republic of Yugoslavia to meet its outstanding debts. The external auditor has expressed appreciation for the Secretariat's efforts in pursuing outstanding assessed contributions, but says "the success of such efforts is not very convincing" (IAEA, 2011a: 19).

THE REGULAR BUDGET

The Agency currently divides its regular budget into six major programs: Nuclear Power, Fuel Cycle and Nuclear Science; Nuclear Techniques for Development and Environmental Progress; Nuclear Safety and Security; Nuclear Verification; Policy, Management and Administration Services; and Management of Technical Cooperation for Development.[5] The regular budget does not include the TC Fund, which is funded by assessed voluntary contributions. Nor does it include voluntary, extra-budgetary contributions by member states; the services of experts paid for by member states; or the value of in-kind assistance.

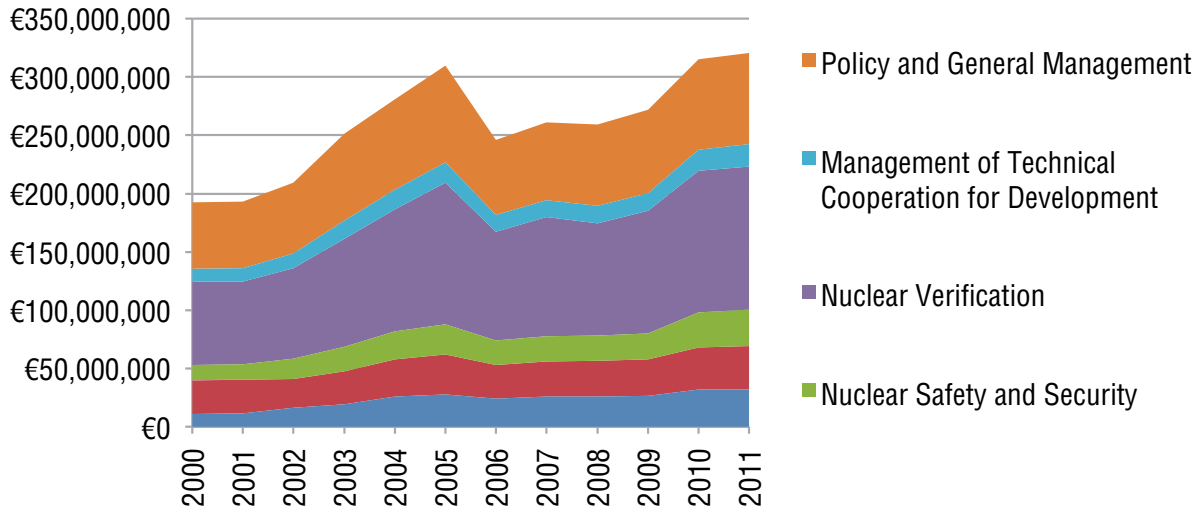
The IAEA has taken the necessary steps to align its budgetary cycles with those common to the UN system by introducing biennial budgeting. This is despite the fact that a statutory amendment adopted by the GC in 1999 calling for a change to such a practice has not yet entered into force for lack of the necessary ratifications by member states. The external auditor has repeatedly enjoined member states to ratify the amendment as quickly as possible to regularize the Agency's actual practice (IAEA, 2011a). The Agency's program and budget process begins two years in advance of the biennium in which programs are to be implemented. This can complicate the budget process, as the original document becomes less relevant as time goes by, and continuous requests are received for modifications in budget projections.

The budget is drafted by the Secretariat, adopted by the BoG and approved by the GC. As the figure below shows, the bulk of the Agency's regular budget goes to Nuclear Verification (36.9 percent in 2009) and Policy and General Management (25 percent in 2009), which together account for two-thirds. Nuclear Safety and Security currently only account for around 7.8 percent. The noticeable spike in overall Agency expenditure in 2003–2005 was the result of a US initiative to enhance the IAEA's role in nuclear security by increasing regular budget spending in that area (IAEA, 2003a).

4 States were put into four categories based on their per capita GNP, with poorer states being phased out over a longer period of time. De-shielding began for three states in 2006, 113 in 2008 and three in 2009.

5 This funds only the management of TC and not TC projects, which are accounted for in the TCF.

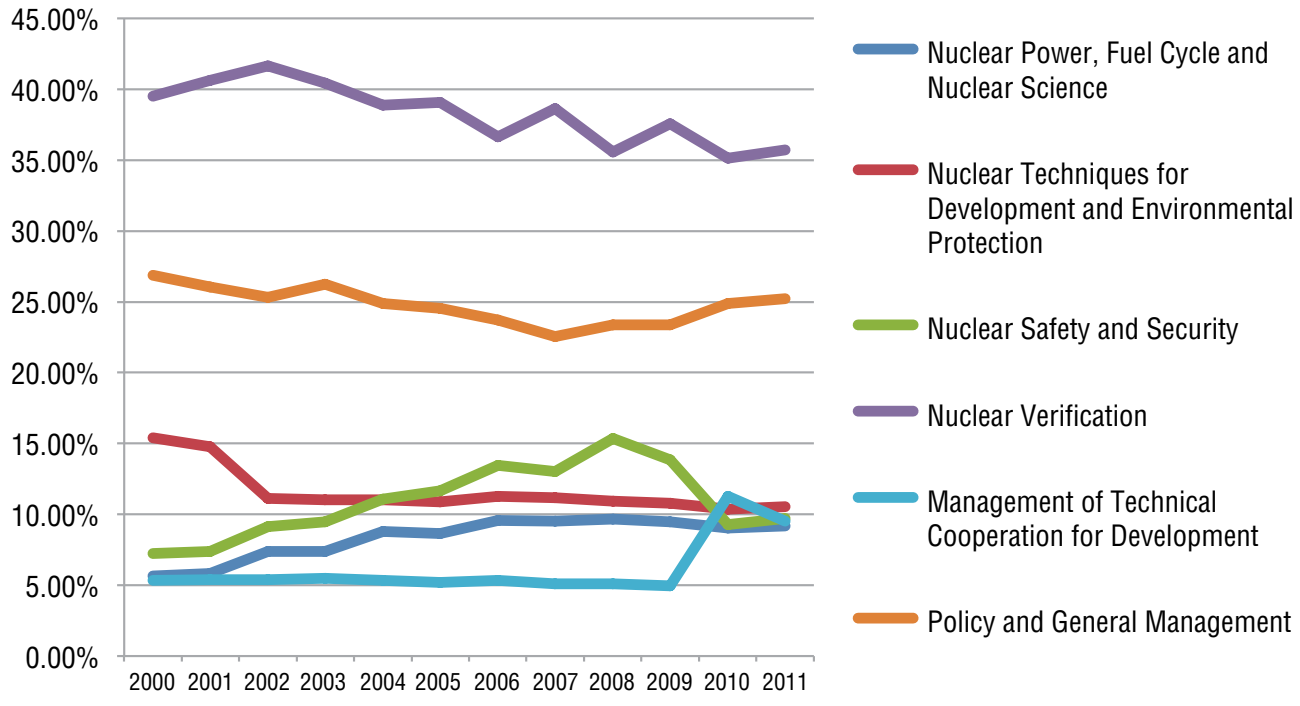
Figure 13: Regular Budget Expenditures, 2000–2011



Source: Adapted from data from IAEA Annual Reports, 2000–2011.

As the figure below shows, over the past decade there has been some decline in the percentages of the budget going to Policy and General Management and Nuclear Verification, while funding for Nuclear Safety and Security, as well as for Nuclear Power, Fuel Cycle and Nuclear Science have risen. The Fukushima disaster will likely result in a relatively minor reallocation of Agency resources to Nuclear Safety, beginning in the 2012-2013 budget (IAEA, 2011c: 4), at least until the priorities of the Post-Fukushima Draft Action Plan become more apparent. Overall, the Agency's regular budgetary priorities are well established and relatively stable.

Figure 14: Percentage of Budget (Regular plus Extrabudgetary) by Program, 2000–2011



Source: Adapted from data from IAEA Annual Reports, 2000–2011.

VOLUNTARY EXTRA-BUDGETARY CONTRIBUTIONS

Not only has ZRG constrained programs funded under the regular budget, but it has also led to increased reliance by the Agency on "extra-budgetary" contributions by member states. During the budgetary process, the Agency identifies core activities that are unfunded in the regular budget that are "expected" to be funded by extra-budgetary funds, and activities for which no funding is currently foreseen. The UN Joint Inspection Unit has called this system a "major cause for concern" (Yussuf, Larrabure and Terzi, 2007: 15), mainly because it prevents proper strategic planning and budgeting.

Paradoxically, the extra-budgetary funding is invariably provided by the very states that imposed ZRG in the first place. They presumably gain political kudos domestically for being tough on international organizations' regular budgets, while using budgetary sleights-of-hand to essentially restore the funding that was cut from their preferred programs. Even a core function like verification has become dependent on voluntary contributions for strengthening measures considered vital by most member states. The Agency's nuclear security program, established in 2002 after 9/11, which one would imagine to be a quintessential core function, but the need for which is questioned by the radical NAM, is currently 80 percent funded from extra-budgetary resources (IAEA, 2011e: 6).

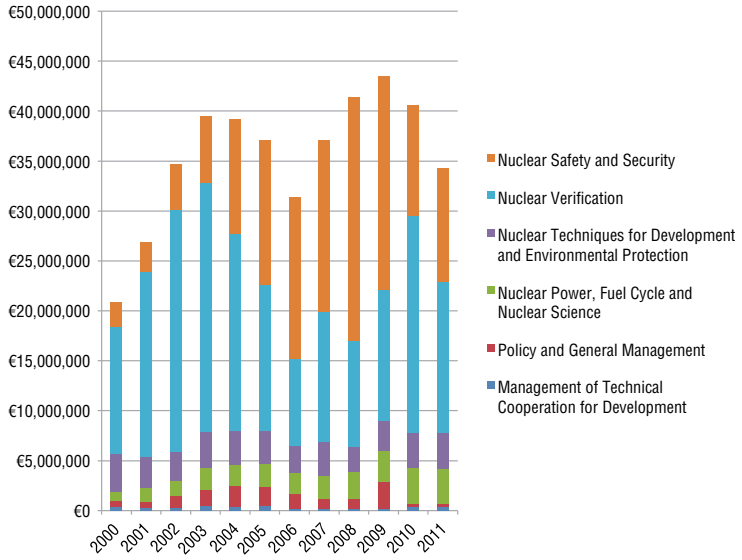
For the Agency, the downside is that the additional funding is usually "conditional," earmarked by a donor for a particular aspect of the Agency's activities. The Secretariat argues that while extra-budgetary contributions are a welcome boost to various programs, they also create uncertainty in its medium- and long-term planning, which would be better served by increasing the regular budget in the first place. Moreover, there are no additional core funds provided for raising, managing and administering extra-budgetary funds. This activity absorbs considerable extra time and resources, especially as the traditional UN budgeting system is not well adapted to such unorthodox funding arrangements (although this is changing with the adoption of a new UN accounting system). The more radical developing countries see the whole voluntary funding arrangement as a Western plot to control the Agency's priorities.

The Agency, like many UN specialized agencies, has even resorted to funding from non-governmental organizations, for some purposes, most notably the NTI, which guaranteed funding for the Low-Enriched Uranium Fuel Bank, providing other donors matched its contribution. The bank is, therefore, entirely funded by extra-budgetary contributions (IAEA, 2011e: 6). But even these statistics do not reveal the full scope of the Agency's dependence on voluntary contributions: the Agency regularly receives the services of experts paid for by member states, as well as in-kind support.[6]

Despite these budgetary contortions, the chart below, combining regular and extra-budgetary expenditures by program, indicate that the latter have not altered the Agency's overall priorities much over the past decade. The big exception is nuclear security, which has doubled the nuclear safety and security share. Given the overall rise in the IAEA budget, this means that nuclear security has not significantly displaced funding for other areas of the IAEA's mandate, but rather added to the total amount available.

6 These were a substantial part of the Agency's resources in its early years (Fischer, 1997: 338-339), but became less important as regular funding sources grew. In 2009, in-kind contributions were valued at approximately US$14 million (The Agency's Accounts for 2009: 120).

Figure 15: Extra-budgetary Expenditures in Support of the Regular Budget by Category, 2000–2011



Source: Adapted from IAEA General Conference Budget Reports, 2000–2011.

SAFEGUARDS VERSUS TECHNICAL COOPERATION

The budgetary issue that has been the greatest source of dispute among its member states for many years, reflecting the starkly divergent priorities among its member states, is the relative balance of funding between verification and TC. A major systemic problem lies in the fact that only administration and verification (safeguards) are described by the Statute as core functions to be funded by the regular budget. The TC program, on the other hand, is not mentioned in the Statute. Although management costs for TC are included in the regular budget, the actual assistance projects are funded by voluntary contributions to a Technical Cooperation Fund (TCF).

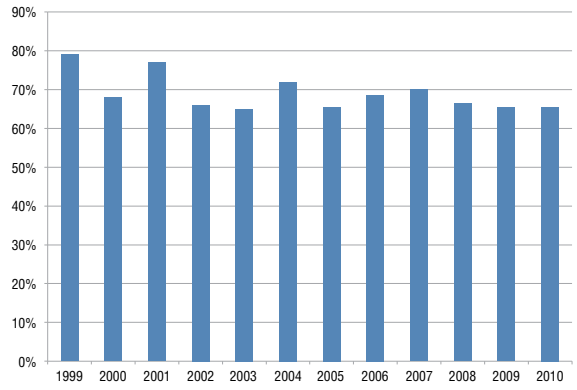
The developing countries have long argued that the Statute intended to give equal, if not greater, priority to the promotion of the peaceful uses of nuclear energy, and that should be reflected in expenditure. After the NPT entered into force in 1970, they watched as safeguards consumed an increasing proportion of the Agency's budget, reaching almost 50 percent by the early 1980s (Scheinman, 1987: 149). This fuelled demands that TC be brought into the regular budget, or failing that, increases in the safeguards budget should be matched by increases in the TCF. Major donor states, on the other hand, have consistently argued that there is no implied balance in the Statute, and that the inclusion of TC funding in the regular budget would be contrary to international "norms" for development assistance (Scheinman, 1987: 251), meaning that international aid should, by its very nature, be voluntary rather than prescribed. While concerned about the precedent that this would set for their contributions to the various UN development agencies, the specific worry of the major donors with respect to the IAEA is that the developing countries would use the regular budget negotiations in the BoG to penalize verification in favour of TC.

In 1981, the GC adopted a resolution calling for TC to be incorporated into the regular budget or be funded by "some other comparably predicted and assured means" (IAEA 1981). The major donors remained opposed to incorporation and that part of the GC resolution was ignored. The same year, however, the Board adopted an "indicative planning approach," under which all member states, including the usual recipients of TC, would agree on three-year targets for their TC contributions, based on the standard UN rate of assessment (Scheinman, 1987). This is the same way, more or less, that the regular budget is calculated. Thus was born the paradoxical idea of "assessed voluntary contributions."

Over the years, the Secretariat has set TC funding goals higher than it expects to obtain, no doubt to placate the developing countries and pressure donor states to keep the TC money flowing. In 2010, the Agency's TCF target was US$85 million, 92.3 percent of which had been reached by year's end. The contributions of most states are usually in line with their target share. The sole exception in 2009 was Canada, which reneged on its approximately US$2.4 million (2.872 percent) payment. A large number of developing countries, mostly small ones, also regularly fail to pay their share, although Mexico is also among them. Some states funded more than their share by supporting worthy projects approved by the Board, but unable to be funded by the TCF in that particular year (these are so-called "footnote-a projects," listed in footnote a of the TC budget).

As Lawrence Scheinman notes, this system has been remarkably successful in producing reliable and rising TC levels (Scheinman, 1987: 251). Data for the past decade shows that growth in the TCF has, more or less, kept pace with safeguards funding, although it has never reached parity and is not gaining on it, as shown in the figures below. Since 2000, the ratio of TC spending to safeguards has remained fairly constant, although with a slight widening trend in favour of safeguards. Overall, the Agency has managed to strike something of a balance that prevents the recurrent rhetoric about the respective funding of safeguards and TC from becoming crippling. The question then arises ether this apparently satisfactory arrangement should be changed. Incorporating TC into the regular budget would make it subject to horse-trading in the BoG vis à vis all of the other regular budget items — an outcome that may not be to the liking of developing states.

Figure 16: Technical Cooperation Funding as a Percentage of Safeguard Funding, 1999–2010



Source: Adapted from IAEA General Conference Reports; Annual TC Reports.

THE CASE FOR INCREASED IAEA FUNDING

As with virtually every organization, the IAEA feels that it can accomplish more with more funds, especially if they are part of a stable, predictable regular budget. In the final years of DG ElBaradei's tenure (which ended in December 2009) there was a sense of financial crisis at the Agency. In June 2007, he decried the Board's refusal to approve an increase of 4.6 percent in the regular budget, warning that the Agency's "safeguards function" was being "eroded over time" (Borger, 2007). In June 2008, ElBaradei reportedly told the BoG that the proposed 2008 budget did not "by any stretch of the imagination meet our basic, essential requirements," adding that "our ability to carry out our essential functions is being chipped away" (Kerr, 2007). In 2008, in a background paper for the Commission of Eminent Persons, ElBaradei called for "a significant increase in funding" to address a "significant shortfall in resources," notwithstanding the Agency's continuing "rigorous" focus on efficiency gains, management reform and internal streamlining (IAEA, 2008a: vi). He derided the Agency's "heavy reliance" on voluntary contributions in key areas such as safety, security and technical cooperation, and the neglect of the Agency's infrastructure.

The Commission of Eminent Persons heeded ElBaradei's warnings and called for regular budget increases of about €50 million annually in real terms, over several years. Although it did not conduct due diligence on the Agency's assessment of its budgetary requirements, the Commission did call for a "detailed review of the budgetary situation and additional workloads of the Agency" (IAEA, 2008h: 30). The ICNND, in 2009, endorsed the Commission's call without further objection. It asserted that if the Agency is to fully and effectively perform its assigned functions, its most critical need is for its regular budget to be significantly increased without any ZRG constraint, "so as to reduce reliance on extra-budgetary support for key functions" (ICNND, 2009: 156).

With the support of the George W. Bush administration, the Agency did gain a one-off increase of 10 percent in 2003, but this was phased in over four years from 2004 to2007 (IAEA, 2003f: 2). In 2009, with the strong support of the Obama administration, another more modest increase was approved by the BoG for 2009-2010: a 2.7 percent price adjustment for inflation and a 4.6 percent real growth increase (IAEA, 2009a: p. viii). The regular budget of €381.3 million saw the largest increases in the fields of nuclear security and safety, technical cooperation administration, nuclear power and nuclear applications. The BoG also approved the establishment of a MCIF to support major infrastructural improvements (IAEA, 2009a), although it was to be funded largely by voluntary contributions.

DG Amano has taken a more cautious approach to his first budgets, in part due to his cautious nature, and perhaps imbibing Japan's current reluctance to continue its traditional international largesse. But the more important factor is the current financial crisis facing many member states. The Geneva Group, comprising the countries that collectively pay for most of the IAEA's budget, have been the drivers of ZRG and normally speak with one voice. More recently, however, divisions have appeared. A subgroup, led most vocally by Canada, supported by Japan and others, has advocated continued ZRG, claiming that there are still inefficiencies in the Agency that need to be corrected before they will consider increases to the budget. The United States under the Obama administration is, on the other hand, a strong advocate of substantial increases in the budget. The Group of 77, unsurprisingly, continues to advocate maximum allocation of budgetary resources to assist them in exploiting the peaceful uses of nuclear energy.

The outcome of these cross-currents for the 2012-2013 biennium was, as usual, a compromise. The GC approved an increase for 2012 of 2.3 percent real growth over 2011 (after an inflation adjustment of 1.1 percent) and no increase in 2013 over 2012 (IAEA, 2011c: iii). The capital regular budget to fund major infrastructure investments was held at €8 million a year for both 2012 and 2013. Extra-budgetary activities (operational and capital) were estimated to be €116 million in 2012 and €110 million for 2013, including €75 million for both years for the LEU Fuel Bank. The NSF was also held at the same level, €19 million per year, as was the TC program, at €109 million per year. The latter does not include the PUI, for which only a "soft pledge" of $10 million had been received to date (IAEA, 2011c: 6). Overall, the IAEA is therefore going into a financial holding pattern for the next two years.

FUTURE FINANCIAL NEEDS OF THE AGENCY

The immediate future financial needs of the Agency are, for the most part, identifiable, but over the longer term they are much hazier. Verification will require continuing increases as the Agency continues to implement strengthened safeguards. The further development and implementation of the State-Level Concept alone presents significant technical and human resource challenges, including the need to identify and acquire safeguards expertise and technology, to increase training in both inspection and analysis, and to advance safeguards concepts and planning. Specialized verification technology is not cheap, although off-the-shelf technologies can provide economies of scale. While a significant effort is underway to redress the years of neglect of Agency infrastructure, there will be a continuing need to maintain the new facilities and continue to pursue advanced technology, where appropriate and necessary.

Although the nuclear energy revival is now in question following Fukushima, there is still likely to be a steady stream of states seeking advice on whether or not to pursue nuclear electricity generation and some new reactors will come online, requiring the imposition of safeguards on both additional materials and facilities. Safeguards coverage, in some cases, will have to be provided in countries with no previous experience of nuclear power. The application of safeguards to multiple Indian nuclear facilities under the 2008 US-India accord, will incur significant costs, estimated to be in the order

of €1.2 million for the first year for each new facility (IAEA, 2008b). The development of safeguards for new generation reactors and fuel cycle technologies and facilities will also require additional funding.

As for possible special verification tasks, the Agency may once again be involved in verifying North Korea's compliance with its nuclear disarmament pledges, if and when the Six-Party Process makes progress (it keeps a team ready and trained for that purpose) (GSN, 2011b).[7] The so-called Leap Day Deal between North Korea and the United States on February 29, 2012, was the first hopeful sign in years that IAEA inspectors may be invited back, this time to verify a halt to uranium enrichment. DG Amano has noted that inspectors could be ready to return within weeks, subject to BoG approval (GSN, 2012). Verification in Iran may also intensify, depending on a future deal over its non-compliance situation.

The US Department of Energy, as part of its NGSI, has commissioned a series of studies to determine the resource requirements of safeguards obligations through 2030. It is hoped that the conclusions will be shared with the Agency, as well as assisting in the NGSI's own forward planning.

The growing area of nuclear security has, in recent years, placed further strain on the Agency's budget and is unlikely to abate, especially given the nexus now being drawn between safety and security. Since Fukushima there have been increasing demands for a greater Agency role in nuclear safety, which is likely to add further pressure on the IAEA budget as the Post-Fukushima Action Plan unfolds. Demand for TC is constantly increasing, not just for traditional assistance in peaceful uses, but for enhancing states' nuclear safety and security.

To ensure that the IAEA is adequately financed and is able to carry out its mandate in full, the Agency needs to ensure that it is as transparent and as convincing as possible in identifying its financial needs. There have been continuing complaints from member states about the opacity of the Agency's budgetary requirements and requests for increased funding. It missed a perfect opportunity to rectify this in its background paper to the 20/20 Commission, but neither the Secretariat nor the Commission undertook a detailed examination of the Agency's funding requirements. The Secretariat also needs to continue to demonstrate that it is as efficient as possible. In 2011, DG Amano announced that all department heads had been asked to identify cuts of five percent for 2012-2013 (the identified "savings" would then be ploughed back into priority activities) as a mechanism for driving management and organizational efficiencies. A harder exercise would be to develop a proper strategic plan and force each department to identify priorities in order. Greater emphasis on transparency and efficiency should identify specific problem areas, which may help loosen state wallets during tumultuous economic times.

The SAL is probably the best example of how member states will respond to a specific, well-documented request for urgent additional funding. The laboratory was increasingly in disrepair and in desperate need of upgrading. The Agency identified modernization as a priority, prepared reasonable financial estimates for the work necessary and made a point of giving tours of the facility to show diplomats, civil servants and experts (including this author) the poor state it was in. The IAEA has subsequently received sufficient voluntary contributions to at least make a substantial start on the project.

Identifying specific challenges and solutions, with an identifiable deliverable, is likely to be a much more effective strategy than requesting overall increases to the Agency's regular budget. However, it is not possible to mount high-profile funding drives for all IAEA activities: few are as visual or as compelling as a deteriorating laboratory. Moreover, like most governmental budgets, much of the Agency's expenses are fixed — among them salaries, operations and maintenance, statutory requirements and legally obligated activities — leaving little in the way of discretionary spending to provide room for budgetary manoeuvres.

The Agency also needs to prioritize among its various mandates and functions more than it has done in the past, and to discard altogether some functions that are no longer appropriate. Former DG ElBaradei suggested certain activities that the Agency had carried out for many years could be outsourced, partnered or left to other players — public or private (IAEA, 2008a: vi). No doubt he had in mind some of the technical assistance and equipment that the Agency has traditionally provided to states for their nuclear energy programs and other peaceful uses. When the IAEA was the only source of materials, equipment and advice for agricultural, medical and other peaceful uses of nuclear energy, it made sense to provide this. However, with the growth of commercial suppliers, an increase in the number of states that have mastered the technology as well as the greatly improved financial situation of many developing states, it is not clear if the Agency should be involved any longer in providing equipment, except to the least developed states which obviously cannot afford it. The external auditor recommended in his 2010 report that "as a matter of priority, TC needs to explore partnership opportunities with a much broader range of stakeholders" (IAEA, 2011a: 29), at least in part so that costs and risks could be shared.

Finally, the Agency should commission a proper management consultancy review of its programs and finances, and a proper study of projected future needs to inform its budgetary process and satisfy major financial contributors. As indicated above, the MANNET report fell far short of what was required, even at the time (for instance, financial accounts were not examined) and certainly it is now out of date. The Agency should ask the consultancy to consider new financing models for the Agency.

7 In November 2011, North Korea suggested that the IAEA send inspectors back to verify that its newly revealed uranium enrichment plant was for peaceful purposes only (Global Security Newswire, 2011).

ALTERNATIVE FUNDING MODELS AND SOURCES

Over the years, many alternative funding arrangements for the Agency's regular budget, and for raising extra-budgetary funds, have been proposed. None of them would replace the traditional method of funding by state contributions according to the UN assessment system, but rather would supplement and diversify the sources of Agency funding. Some have more chance of being realized, in political and practical terms, than others.[8]

An IAEA Endowment

One idea is to establish an IAEA endowment funded by substantial donations from wealthy individuals or foundations (presumably along the lines of NTI). Tom Shea calls this a Non-proliferation Endowment (2008: 329), but it could fund the IAEA and its activities alone. Such an endowment is, of course, dependent on attracting donations to finance activities that may be properly regarded as the responsibility of governments. However, NTI has already made a contribution to the Agency's work in respect of the LEU Fuel Bank, so the precedent has been set. It is up to the DG to use the prestige and authority of his or her office to attract private donations.

A Contingency Fund

At first glance it appears surprising that the IAEA does not have a contingency fund.[9] The Secretariat puts a positive spin on this by claiming that as an alternative it aims to make its budgeting processes as exacting and predictive as possible. But in fact the real reason is that member states have opposed giving the Secretariat a contingency fund out of suspicion that this might encourage lax spending habits (a type of moral hazard). Given that the Agency operates in an often volatile international environment, prone to unexpected revelations of illicit nuclear activity, this seems short-sighted. In the past, the Agency has had to go "cap in hand" to member states for additional funding each time an emergency arose, such as the special verification activities required in Iraq and North Korea.[10]

The Agency's implementation in 2010 of the International Public Sector Accounting Standards (IPSAS) will at least provide a mechanism for the accumulation of funds for infrastructure and other investments (a mechanism that did not previously exist), and will generally improve the management of financial resources and information. But the IPSAS, as ElBaradei warned, "will not alleviate the underlying funding deficit" (IAEA, 2008a: 27).

One way of accumulating funds would be for the DG to ask the BoG to permit the Agency to end its practice of essentially refunding unspent assessed contributions to member states. It does this by calculating unspent funds for a particular year (after waiting a year for all accounts to be paid) and discounting pro rata each state's assessed contribution for the coming year. Such amounts can be considerable in terms of the overall IAEA budget (more than US$1 million at times).[11] Most member states' national treasuries, having committed and transferred their annual contribution to the IAEA, are unlikely to anticipate a refund (although some, like Canada's, apparently do). The BoG has, in the past, taken the decision in some years to move these funds to special purposes, such as capital expenditure. It should make a blanket decision that all surpluses go into an IAEA contingency fund or the MCIF.

Implementing the User Pays Principle: A Surcharge, Tax or Fee for Service

Proposals have long been made for moving more to a "user pays principle" in funding the IAEA, on the grounds that the countries receiving the most benefit from the Agency are not necessarily the ones paying for it. Clearly, all member states (and non-members for that matter) benefit from the global nuclear governance and order that the IAEA provides for the safe, secure and proliferation-resistant use of nuclear energy for peaceful purposes. This is, in effect, the assumption behind the assessed contribution system. Beyond that, however, the states that pay the most for the Agency (the Western states) are not necessarily the ones that derive the most benefit. Nor are the nuclear industries of particular states, beyond the taxes they pay (if they are private) necessarily paying for the benefits they receive from global nuclear governance provided by the Agency.

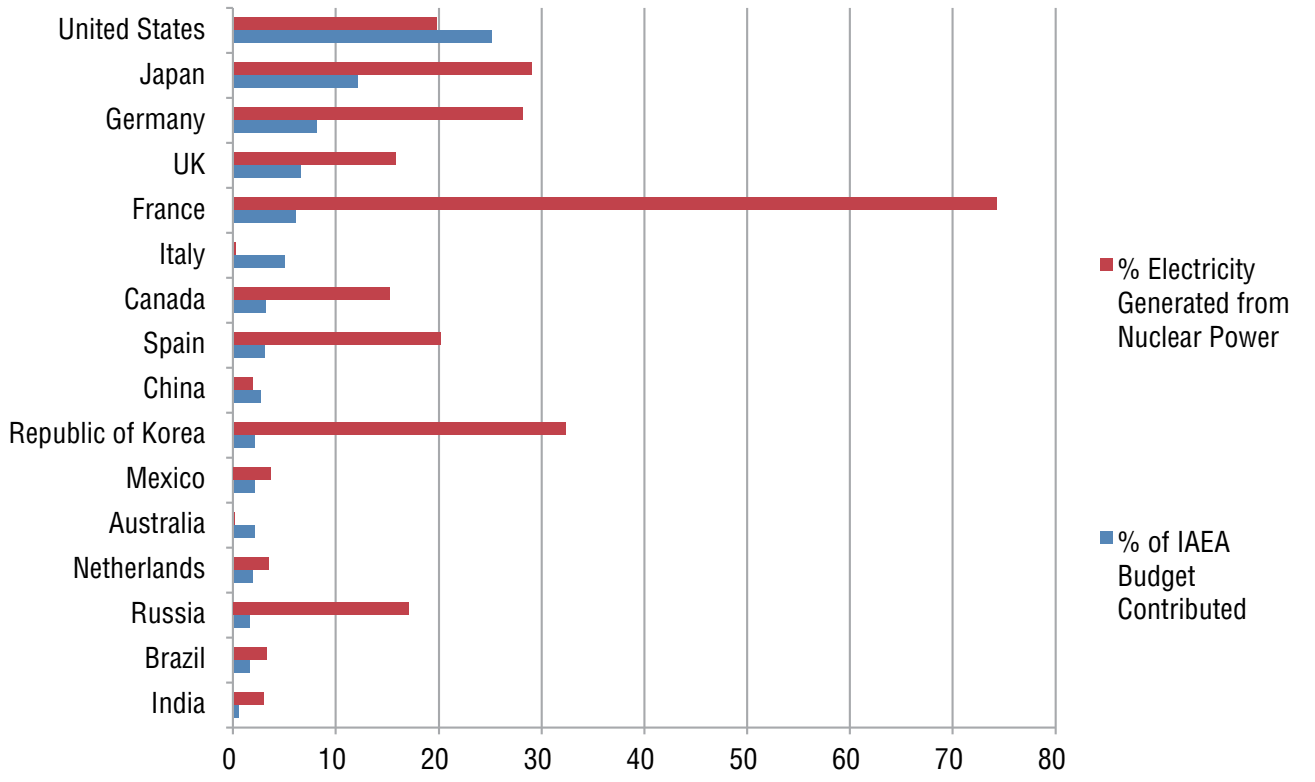
8 Tom Shea has suggested several ideas, including a Non-proliferation Endowment; a surcharge on electricity generated by nuclear energy; marketing Agency services for setting up and managing various types of nuclear project; tax-exempt non-proliferation bonds; and having industry bear a greater share of safeguards costs (Shea, 2008: 323–335).

9 There is a Working Capital Fund which allows the DG to temporarily disburse up to €500,000 toward any projects approved by the BoG, but which has not yet received the necessary funding. The BoG approves the level of the WCF each year, although it has remained about 5 percent of the regular budget appropriation for much of the last decade.

10 The Agency's budget identifies "Core Activities Unfunded in the Regular Budget," but these are not unanticipated activities, but rather those that should have been in the regular budget had funding permitted, or which involve a degree of uncertainty about they will be implemented or not (IAEA, 2011b: 7).

11 According to David Waller.

Figure 17: Top 10 Contributors to IAEA Budget and Selected Others with Domestic Nuclear Shares of Electricity Generation (2011)



Source: Data retrieved from IAEA (2011ff); Electricity Generation Data derived from World Nuclear Association. "Nuclear Shares of Electricity Generation." Available at: www.world-nuclear.org/info/nshare.html.

States with large nuclear infrastructure and industry and which generate nuclear electricity, benefit disproportionately from the IAEA's activities. Among these are China (increasingly so), India, Mexico, Pakistan and Russia, which pay relatively little into the Agency's coffers. They could be asked to pay a surcharge based on the degree to which they derive benefit from nuclear electricity. This would, in effect, be all of the "quasi permanent" members of the BoG, and would also be in recognition of their special responsibilities in the nuclear field. The states concerned could pass on the costs to their nuclear industry. While the industry may see nuclear safeguards, for instance, as an unnecessary burden on them, they often do not pay for the equipment or installation costs that the IAEA incurs in order to safeguard their plants and materials. In the meantime, of course, they benefit free of charge from the standards, guides, and advisory and peer review services that the Agency provides in the fields of safety and, increasingly, security.

Recipients of TC are supposed to pay a National Participation Cost of five percent of their national program, including national projects and fellows, and scientific visitors funded under regional or interregional activities. At least half of the assessed amount must be paid before contractual arrangements are made, while the remainder is payable on completion of the project (IAEA, 2010e: 52). This system is not entirely successful and of recoups very little of the actual costs.

Roger Howsley contends that the Agency's current "business model" is unsustainable,[12] presumably meaning that increasing funding requirements cannot be fully met by the existing system. It should be changed over time, he suggests, to an increasingly user-pay system for a wide range of Agency "services," including nuclear safeguards, safety and security reviews, and assistance, as well as assistance with nuclear energy plans. Such a system could be a levy on the amount of nuclear electricity generated per country; as a tax or surcharge on nuclear exports and imports, including lucrative source materials such as uranium and thorium; or as some composite number based on the size and sophistication of a state's nuclear fuel cycle. A radical version of this would include the entire fuel cycle of the NWS, including the military sector, on the grounds that it is those states that have caused so much difficulty for the rest of the international community in the first place. DG Amano seems to be at least partially amenable to such ideas, telling a press briefing in June 2011 that "We should not stick to the traditional

12 Interview with Roger Howsley, Vienna, October 5, 2011.

ways of receiving funds from governments," but that the IAEA may partner with "private companies, associations and industry to pay for expanded safety reviews" (Tirone, 2011).

One promising idea from Tom Shea is for the Agency to estimate the cost of applying safeguards to new facilities, and asking construction companies to factor these into the total cost paid by the buyer (2008). A start could be made with Generation III and IV reactors, which may have novel safeguards requirements. They would be a minimal addition to the overall purchase price, and would relieve the Agency of some of its costs. Such details could be worked out as part of the Agency's work on "safeguards by design" and could harness the new commitment by industry to an exporters code of conduct.[13] The 20/20 Commission recommended that the Agency develop a mechanism whereby the "monetized value of the reduction of risk resulting from Agency activities" could be applied to member states' assessments. The Agency should also, it suggested, consider other user or participation fees for its services, "keeping in mind both the needs of developing countries and the need to maintain incentives for states to accept safety and security reviews" (IAEA, 2008h: 31).

There is likely to be resistance from industry and member states to such ideas, much along the same lines as opposition to a proposed tax on airline tickets to pay for UN development goals made by French President Jacques Chirac in 2006, which sank without trace, despite gaining support from then UN Secretary-General Kofi Annan (BBC, 2006). As in the case of other novel forms of funding for the Agency, much will depend on the vigour with which such ideas are pursued by the DG, supportive member states and other stakeholders. In the meantime, a more promising avenue may be for the Agency to seek fee payment for the more costly services it provides to member states.

A Resource Mobilization Strategy

A 2007 report by the UN Joint Inspection Unit (JIU) noted that the IAEA, unlike the WHO, UNICEF, UNEP and UNCTAD, did not have an explicit resource mobilization strategy (Yussuf, Larrabure and Terzi, 2007: 33). This is despite the fact that, as the MANNET report noted, DDGs, division directors and section heads all reported "significant time and resources committed to fundraising for extrabudgetary activities" (Campbell et al., 2002: 11). Such strategies are designed to strengthen the capacity of an organization to increase funding from both traditional and non-traditional sources, improving stability and predictability, broadening the donor base, and stimulating the use of innovative fundraising techniques. The JIU recommended that the IAEA do so. It should include consideration of at least some of the proposals raised above. The Agency has, in the past, experimented with some minor attempts at external fundraising, but these proved disappointing. A Statement on Resource Mobilization was apparently drawn up several years ago, but little concrete results ensued. In the 2012 budget, however, there is a modest allocation of funds for employing a fundraising officer, so this situation may change.[14]

OTHER BUDGETARY REFORMS

In 2010, the Agency introduced a number of long overdue budgetary reforms that should prove beneficial (IAEA, 2011c: 4-5). First, funds were eliminated for positions that are unlikely to be filled in the current budget period, abolishing the old system of budgeting for vacant positions. Further, in order to simplify planning and budgeting for staff, and to align the Agency with UN system best practice, positions were now to be budgeted at a standard cost, using average estimates, rather than costs based on individual incumbents. From 2012, flexibility will be given to managers to deal with staff requirements arising from unexpected program reorientation. Within established boundaries, managers will be able to reallocate staffing allotments to priority areas.

For the first time, risk management has become part of the Agency's modus operandi, at least partly at the urging of the external auditor. Policy and guidelines were developed and adapted for the 2010-2011 biennium. A risk register template was designed and incorporated into the Programme and Budget Information System for use by program managers. A comprehensive review of the progress made so far has reportedly been conducted, and follow-up action taken. Steps were also taken to make the 2012-2013 Programme and Budget document "leaner, easier to navigate, and less expensive without subtracting from substance" (IAEA, 2011c).

A "creeper" issue that could have grave implications for the Agency is one that is facing many governments — unfunded liabilities for future staff retiree health benefits.[15] The 20/20 Commission report mentioned this problem in passing (IAEA, 2008h: 29), but made no recommendations. The Secretariat has repeatedly brought the issue to the BoG, but it has failed to act. Like many of its member states, notably the United States, Italy and Greece, the BoG appears to be in denial over this looming financial squeeze. The Board should act immediately to begin setting aside funds for such "after service liabilities," preferably by seeking an earmarked increase in the Agency's budget in order not to detract from core Agency programs.

13 See Nuclear Power Plant Exporters' Principles of Conduct (2011).

14 According to David Waller.

15 This is especially a concern in the unlikely event that the IAEA were to be closed down. In the case of staff pensions, these are covered by the common UN Joint Staff Pension Scheme, which would absorb the liabilities.

RECOMMENDATIONS: A GRAND BUDGETARY BARGAIN?

Given the budgetary situation of the Agency described above, it would appear that matters are ripe for a grand budgetary bargain. Key elements pointing in that direction are:

- regular budget funding for both verification and TC have been rising roughly in lock-step;
- for at least a decade now, and each side seems to be having its needs met;
- the shielding system is rapidly disappearing, meaning that the regular budget is increasingly funded by all states based on the normal UN system;
- extra-budgetary funding and cost-free experts are already costing major donors more money beyond their assessed contributions;
- many TC projects now involve assisting developing countries to improve their capacity for ensuring nuclear safety and security, outcomes that are in the direct interest of the major donor countries; and
- the initiation by the United States in 2010 of the PUI, which is intended to provide $100 million over five years for peaceful uses, is a substantial boost to the TC program and one deliberately designed to meet developing country demands.

A grand bargain could contain the following elements:

- adoption of a Statutory amendment to incorporate the TCF and the Nuclear Security Fund into the regular budget (all member states would agree to ratify it within a short period of time to avoid second-guessing the bargain; the BoG could, in the interim, authorize the Secretariat to incorporate this funding into the next budgetary planning cycle);
- to reassure major contributors that the BoG would not hold verification hostage to future increases in TC, a deal would be made to fix the percentage of the regular budget that goes to the various major programs until otherwise decided by Board consensus;
- all other statutory, core activities would be included in the regular budget (extra-budgetary contributions and cost-free experts would be limited to non-core activities);
- the shielding system would be abolished immediately; all IAEA member states would pay for the regular budget based on their regular UN assessment; and
- a formula would be devised whereby member states with large peaceful nuclear industries, whether for generating electricity or producing source materials, would pay a surcharge based on the size of their industry.

OTHER RECOMMENDATIONS

- The Secretariat should adopt a resource mobilization strategy.
- The BoG should authorize the establishment of a Contingency Fund and an IAEA Endowment.
- The BoG should issue a blanket authorization for the Agency to put annual surpluses into the Contingency Fund, rather than being returned to member states.
- The BoG should immediately authorize provision in the budget for gradually dealing with unfunded staff health liabilities.

The IAEA press briefing on North Korea on January 6, 2003 received worldwide coverage. (IAEA Photo by Dean Calma)

CONCLUSIONS AND RECOMMENDATIONS

The IAEA is, in many respects, the nucleus around which all other parts of the global nuclear governance system revolve. The role it plays in international peace and security, considering its capabilities, size and budget, makes it an indisputable bargain. The IAEA's independent, impartial and authoritative role in nuclear safeguards and associated nuclear verification is irreplaceable. Its nuclear safety role is well established and set to grow following Fukushima. Its impact in the area of nuclear security is expanding and has great potential. The Agency's disinterested promotion of nuclear energy in states where it is appropriate, affordable and subject to the achievement of necessary milestones, can only be done by a multilateral organization like the IAEA. It is the only organization with the legitimacy and credibility to oversee the formulation and dissemination of global norms to guide the peaceful uses of nuclear energy and to help socialize the full range of states, from the most advanced to those with minimal nuclear potential, into adopting and abiding by them. The Agency's technical assistance to developing countries is an essential component of the nuclear non-proliferation bargain. While UN or other development agencies could carry out such work, only the IAEA is able to provide the needed safety, security and non-proliferation context. As an impartial facilitator and, in some cases, active driver of treaty implementation, the Agency plays a part that even the most powerful of states could not manage alone. In monitoring, verifying and assessing compliance with non-proliferation treaties, the IAEA helps insulate such processes to the extent possible from the political fray. Finally, the Agency continues to build an international nuclear community imbued with the principles of good governance, engaging not just member states and their various national bodies, but the scientific and technical community, industry, other international organizations and civil society.

It was beyond the scope of this report to comprehensively compare the Agency with other similar international organizations, so a definitive, measurable assessment of its relative efficiency and effectiveness has not been possible. Given the uniqueness of the

Agency's mandate this may in any case have been a fool's errand. Nonetheless, by all accounts, the IAEA is regarded as one of the most effective and efficient in the UN family of organizations. The Secretariat's technical competence and professionalism is highly regarded. The Agency employs hundreds of talented and dedicated civil servants who truly believe in the ideals of the organization. Some, in hostile verification environments and during nuclear accidents, have been prepared put themselves in harm's way for the cause.

Zero real growth has forced the Agency to stay relatively compact and to continuously seek efficiencies, as least in certain areas. The organization has in many respects evolved deftly over the past 50 years, shedding unrealizable visions, seizing new opportunities and handling with aplomb several international crises into which it has been drawn. It has learned from the failures of its safeguards system, from nuclear accidents and even from a so-far hypothetical nuclear terrorist attack. The scope of its work has expanded, as has its complexity and sophistication.

The first conclusion of this report is consequently that, like the United Nations itself, if the Agency did not exist it would have to be invented. So important is the work of the IAEA that the question of doing away with it does not warrant serious consideration.

DOES THE AGENCY NEED STRENGTHENING AND REFORM?

The assumption at the outset of this project was that the IAEA did need strengthening and reform, and the research confirms this conclusion. Not only does the Agency, like any human institution, especially a bureaucratic one, have flaws and limitations, but it is also facing growing expectations and significant challenges arising, in large part, from the often unpredictable environment in which it operates.

For many observers and member states, the governance of the IAEA through its GC and BoG has deteriorated in the past decade or so. The "spirit of Vienna" has dissipated, replaced by sharp divisions over matters previously considered mundane or purely technical. Two member states in particular are responsible: Iran, especially since 2003, and the United States under the administration of George W. Bush. The G77 has contributed by allowing itself to be drawn in by Iran and fellow radical states. The Geneva Group has not helped by being overzealous in pursuing budgetary stringency at the expense of effectiveness. Broad divisions between the increasingly outmoded categories of developed and developing countries and between NPT supporters and its non-parties and detractors hover over the Agency.

Leadership is critical to the effectiveness of any organization. The previous DG, Mohamed ElBaradei, was an energetic champion of the IAEA's role and prerogatives, and led it through several treacherous periods. Yet he overreached his mandate in several directions and, by association, endangered the Secretariat's previous reputation for keeping strictly to its core competencies. Beyond expected and natural policy disagreements, he also unnecessarily aggravated the Agency's relationship with its principal funder and long-time champion, the United States. The current DG, Yukiya Amano, has reversed course, re-emphasizing the Agency's technical role and adopting a firmer stance on non-compliance. The danger is that he has swung too far in the opposite direction, underplaying the Agency's authorities, missing opportunities and being too attentive to Western concerns. There is a fine balance between being an activist DG and seizing opportunities on the one hand and getting ahead of member states' preferences on the other. There is also a fine line between politically astute attentiveness to major contributors and supporters and being seen to kowtow to them to the detriment of "ordinary" member states. Above all, the DG needs to be the servant of all member states and disinterested and fair in his dealings with each of them — a difficult balancing act requiring constant attention.

Organizationally and managerially, the Agency continues to be hobbled by several long-standing structural constraints. A high (and increasing) level of concentration of authority in the DG's office, combined with a flat second tier of deputies leads to unhealthy competition for attention, influence and resources, detracts from the "one house" ideal and accentuates the tendency of DGs to act magisterially. This in turn helps perpetuate the Agency's infamous programmatic stovepiping, and leads to the proliferation of programs, projects and mechanisms (perhaps best described as acronym anarchy). The Agency also lacks a proper strategic plan and planning process and an agile, flexible recruitment and staff retention policy. The staff rotation policy has disadvantages that concern key member states. Inadequate staff assessment, counselling processes and career development planning mean unproductive staff may affect efficiency. Future staff health benefit liabilities, meanwhile, are grossly underfunded.

As for infrastructure, the Agency's current, welcome upgrade and renovation of its laboratories is proceeding as planned but is far from fully funded. Seeking to manage such a large infrastructure project in-house was probably a mistake. Ensuring the Agency manages its new capacities properly and continues to upgrade them as necessary will require continual attention: its technical reputation depends on it. Although significant IT improvements are currently underway, the Agency's capacities need to be dragged further into the twenty-first century, again to preserve and enhance the Agency's reputation, but also to help break down intra-agency barriers to communication, transparency and information sharing. The Agency overall exhibits a lack of transparency — from safeguards reports, through the budget, to TC proposals — that frustrates member states and other stakeholders alike and does the Agency a disservice in garnering international support for its efforts. As the Fukushima incident demonstrated, the Agency's crisis communications strategy needs attention. The organization has been nimble in adapting to social media but its website, although much improved in recent years and now visually inviting, needs major renovation below its primary and secondary levels.

Programmatically, the best-funded and largest program, nuclear safeguards, seems motivated to reform and has been considerably strengthened in recent years through new approaches, technologies and attempts to change the old safeguards culture. But verification of bulk-handling facilities and detecting undeclared activities and materials remain great challenges that are not being matched by the required technologies and resources. The Agency's role in nuclear safety remains hobbled by member states' reluctance to commit to mandatory measures, even after Fukushima. Its emergency response capabilities exhibited mixed outcomes during the Fukushima disaster and need careful reconsideration. The nuclear security tasks accorded to the Agency by member states, although growing, tend to be modest and supportive of external efforts rather than being at the heart of the matter. As in the nuclear safety field, all of the Agency's offerings are non-binding on member states. The nuclear summits, not the IAEA, are the principle international forum for discussing nuclear security. TC has long been undermanaged, under-resourced and overexploited by some states. Change is essential in order to fulfill the expectations of the truly needy developing country recipients and in order to encourage greater donor largesse.

The mindless imposition of zero growth funding on the Agency by the Geneva Group has seriously affected its infrastructure, human resources and ability to adopt modern management and technical tools over the long term. Voluntary funding and secondment of experts by member states is helpful in filling gaps, but distorts planning and prioritization over the longer term. The linkage between spending on verification and technical cooperation is dysfunctional: both sides of the argument need to compromise to resolve this issue once and for all. The shielding system is no longer appropriate given the near universal application of nuclear safeguards. Newly emerging economies, notably Brazil, Russia, India and China, are not pulling their weight in funding the Agency. The DG and Secretariat have not fully explored alternative funding possibilities. Overall, while this report does not propose a formula or figure for increasing the Agency's budget, it is an inescapable conclusion that the Agency is significantly underfunded, considering its responsibilities and the expectations increasingly being placed on it. Fukushima has reinforced this conclusion.

In terms of its role in the international nuclear community writ large, the Agency does not always fulfill such expectations. Although it has close relationships with some UN agencies, especially those with which it operates joint programs or centres, it is distant from others. Despite the amount of interaction it has with developing countries, it is not well integrated with multilateral development assistance network. Despite being the lead agency for nuclear emergencies, it did not lead particularly well in the Fukushima disaster. The IAEA's relationship with the industry for which it is meant to provide global governance is often at arm's-length. Its relationship with other stakeholders is mixed: it interacts well with the science and technology community, especially on safeguards, but less well with regulators, the policy community, civil society and the general public.

One of the Agency's major challenges is to meet the expectations of its member states and other nuclear stakeholders, which are often unrealistic and, in the case of member states, not matched by the necessary funding and other resources. By being more transparent, open and honest about the functions it can and cannot fulfill, and more diligent in providing convincing justification for funding increases in particular programs, the Agency can attenuate the problem. It should also beware of raising unrealizable expectations itself: in its own "propaganda" it should not describe itself as the hub, central point or focal point of a particular realm, unless it is truly able to fulfill such functions.

FUTURE CHALLENGES

In addition to meeting current expectations, the Agency also needs to prepare itself for future challenges. Since verification can never be 100 percent effective, and in the case of nuclear safeguards needs to be implemented in perpetuity, the Agency needs to indefinitely seek improvement in its capacities, while balancing costs, feasibility and member states' sensitivities about intrusiveness, confidentiality and sovereignty. As the IT revolution continues apace, the Agency needs to keep up if it is to have a chance at handling the flood of data that will continue to exponentially descend on it. It also needs to put in place the most dependable systems for acquiring and utilizing intelligence information provided by states.

Complacency is always a challenge in permanent verification bodies. In recent decades, serious non-compliance cases have arisen with alarming frequency: the Agency needs to be prepared for more surprises, notwithstanding ongoing strengthening of safeguards. The risk assessment approach being adopted by the Safeguards Department should be applied to the whole organization, as recommended by the external auditor. The Agency's ability to detect undeclared activities and detect and analyze weaponization activities needs further development, both to improve verifiability and to act as a deterrent. Its tracking of nuclear smuggling and illegal export/import requests needs strengthening. The Agency also needs to be prepared for the possibility that Iran will acquire nuclear weapons and leave the NPT, potentially triggering a cascade of proliferation in the Middle East. In re-engaging with North Korea, the Agency will need to develop credible and sustainable means of verifying a uranium enrichment freeze, in addition to reinstituting its past activities in respect of plutonium production and, ultimately, de-weaponization, if agreed.

Meanwhile, the Agency should prepare for the possibility of being asked to contribute to verifying future steps towards global nuclear disarmament. Given its current role and capacities and to avoid the costs of setting up a new body, the IAEA is the most logical and appropriate body to verify a future FMCT. Negotiations with Russia and the United States have indicated that, with further technical work, the Agency should also be entrusted with verifying the disposition of non-sensitive fissile material from a continuing nuclear drawdown of their nuclear weapon stockpiles. The Agency could be entrusted

with a similar role in respect of the other nuclear weapon states, with the appropriate safeguards in place.

While Fukushima has put a damper on the prospects of a global nuclear revival on the scale envisioned just a few years ago, there is a possibility that rapidly advancing global warming will convince more states that, despite its drawbacks, nuclear power should be part of their national energy mix for cutting greenhouse gas emissions. A crash program of nuclear power reactors in certain states could still be launched in coming decades. The Agency needs to be prepared for such an eventuality by honing its capacities to provide advice, counsel and assistance to its member states.

STRENGTHENING AND REFORM PROPOSALS: THE FINAL CUT

The IAEA is hardly an organization that is standing still. Reform and strengthening are already occurring in a number of areas. Unless otherwise indicated, this report endorses the efforts already underway and, in many instances, recommends that they be pursued with greater vigour. This report also identifies a raft of other possibilities, both major and minor, for improving the Agency's performance in the short to medium term.

The following list represents the final cut — the most important steps, stripped of qualifiers and diplomatic niceties, which should, in the view of the author, be taken. It seeks to pinpoint where responsibility lies for taking each step, whether with member states, the DG or the Secretariat. In most cases, however, change will only be achievable if all the players work in tandem. Although there are reforms that the DG and Secretariat can themselves initiate, in almost every case they will require additional funding that can usually only be provided by the member states holding the purse strings.

MAJOR RECOMMENDATIONS FOR STRENGTHENING AND REFORM

For member states collectively:

- **On governance:** Hold the GC every two years; scrap Board expansion; open all seats to all member states elected regionally.
- **On management:** Limit the DG to two four-year terms; approve appointment of a single DDG; commission a proper, wide-ranging external management consultant report.
- **On nuclear safety:** Fully implement the Action Plan and fund it properly.
- **On peaceful uses:** Dedicate TC solely to the least developed countries.
- **On funding:** Negotiate a budgetary grand bargain that resolves multiple legacy issues, including bringing TC and nuclear security into the regular budget; establish a Contingency Fund and IAEA Endowment; fully capitalize the MCIF; fund staff health liabilities.

For individual member states or groups of states:

- **Geneva Group:** Replace automatic ZRG with a needs-based approach.
- **United States:** Pay assessed contribution early in the IAEA's budgetary year.
- **Other major countries (especially Brazil, China, India and Russia):** Assume greater responsibility for governing and funding the Agency, starting with matching the US Peaceful Uses Initiative.

For the DG:

- **On management:** Avoid overcentralizing authority in the DG's office; appoint a single Deputy and create a new third tier of management; develop an in-house strategic plan; commission a new independent management study; seek increased flexibility in personnel policies, especially recruitment; break down departmental stovepiping; increase transparency and openness.
- **On nuclear safety:** Continue to promote and implement post-Fukushima Action Plan; continue to pursue mandatory IAEA-led peer review, in cooperation with WANO (and INPO); encourage nuclear regulators to establish an international body; lead an effort to establish a global nuclear safety network.
- **On nuclear security:** Initiate biannual nuclear security conferences at the IAEA as successor to the nuclear security summits; upgrade the Office of Nuclear Security to a department with additional regular budgetary support and expertise.
- **On non-compliance:** Formalize standardized terminology and approaches, and reinforce review team processes for controversial, high-profile non-compliance and verification reports.

For the Secretariat:

- **On safeguards:** Fully implement Safeguards Strategic Plan; continue to enhance capabilities for detecting non-declared activities, weaponization, nuclear smuggling and illicit technology transfers; make Safeguards Implementation Reports public.
- **On nuclear safety:** Continue to promote and fully implement the post-Fukushima Action Plan; review and strengthen emergency response, including emergency database and communications strategy; institutionalize cooperation on environmental radioactivity monitoring with CTBTO.
- **On TC:** continue to improve transparency, efficiency, accountability and sustainability; redirect program to the least developed states; encourage safety, safeguards and security enhancement projects.
- **On management:** Institute modern personnel procedures for recruitment, management, assessment, counselling and career planning; pursue the most modern management approaches, including risk management, in all parts of the Agency's operations.
- **On technology:** Continue renovation of the Agency's IT capabilities as a priority.
- **On infrastructure:** Continue to pursue modernization of Seibersdorf facilities and ensure continuing maintenance and upgrading as required.
- **On funding:** Improve presentation of the "business" case for increased funding in priority areas; develop a Resource Mobilization Strategy.
- **On public diplomacy:** Develop more effective outreach strategies, including the website, especially for nuclear emergencies and crises.

While the IAEA is often loftily described as objective and independent, in reality it is only as objective and independent as its member states allow it to be. Those observers who decry the lack of action by the Agency in particular areas of its work, or who see an allegedly distorted set of priorities or inappropriate trade-offs need to identify who is ultimately responsible: often it is a member state or member states. Member states may and do legitimately disagree on mandates, priorities, programming, funding, staffing and technology, in addition to sensitive issues like verification and compliance. They also less legitimately seek to interfere in and unduly influence Agency processes such as staff recruitment and placement; try to undermine initiatives they disagree with; and, as major funders, seek undue influence. Missions in Vienna accredited to the IAEA range from the tiny and indifferent to the large and all-pervasive. The Agency is often trapped trying to judiciously please them all.

Since it is states that established the IAEA, pay for it, provide its personnel and other resources and grant it the necessary privileges and immunities, it is they that ultimately control its destiny. While it is true that like many organizations the Agency has assumed an independent identity and presence in international affairs that no one member state can gainsay, and that in some circumstances it has some room for independent manoeuvre, especially by balancing the interests of various member states, ultimately it is constrained by the strong preferences of its membership as a whole or those of key, active member states. It is thus to the member states that we must look to trigger and sustain lasting strengthening and reform — and unleash the nuclear watchdog.

ANNEXES

The Members of the Agency

On February 17, 2012 the 153 Members of the Agency were as follows:

Afghanistan, Islamic Republic of
Albania
Algeria
Angola
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahrain
Bangladesh
Belarus
Belgium
Belize
Benin
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Central African Republic
Chad
Chile
China
Colombia
Congo
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Democratic Republic of the Congo
Denmark
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Eritrea
Estonia
Ethiopia
Finland
France
Gabon
Georgia
Germany
Ghana
Greece
Guatemala
Haiti
Holy See
Honduras
Hungary
Iceland
India
Indonesia
Iran, Islamic Republic of
Iraq
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Korea, Republic of
Kuwait
Kyrgyzstan
Lao People's Democratic Republic
Latvia
Lebanon
Lesotho
Liberia
Libya
Liechtenstein
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Mali
Malta
Marshall Islands
Mauritania, Islamic Republic of
Mauritius
Mexico
Monaco
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Oman
Pakistan
Palau
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Moldova
Romania
Russian Federation
Saudi Arabia
Senegal
Serbia
Seychelles
Sierra Leone
Singapore
Slovakia
Slovenia
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syrian Arab Republic
Tajikistan
Thailand
The former Yugoslav Republic of Macedonia
Tunisia
Turkey
Uganda
Ukraine
United Arab Emirates
United Kingdom of Great Britain and Northern Ireland
United Republic of Tanzania
United States of America
Uruguay
Uzbekistan
Venezuela, Bolivarian Republic of
Vietnam
Yemen
Zambia
Zimbabwe

Source: IAEA (2012). "The Members of the Agency." INFCIRC/2/Rev.70. March 1.

UN Member States and Observers Not Members of the Agency

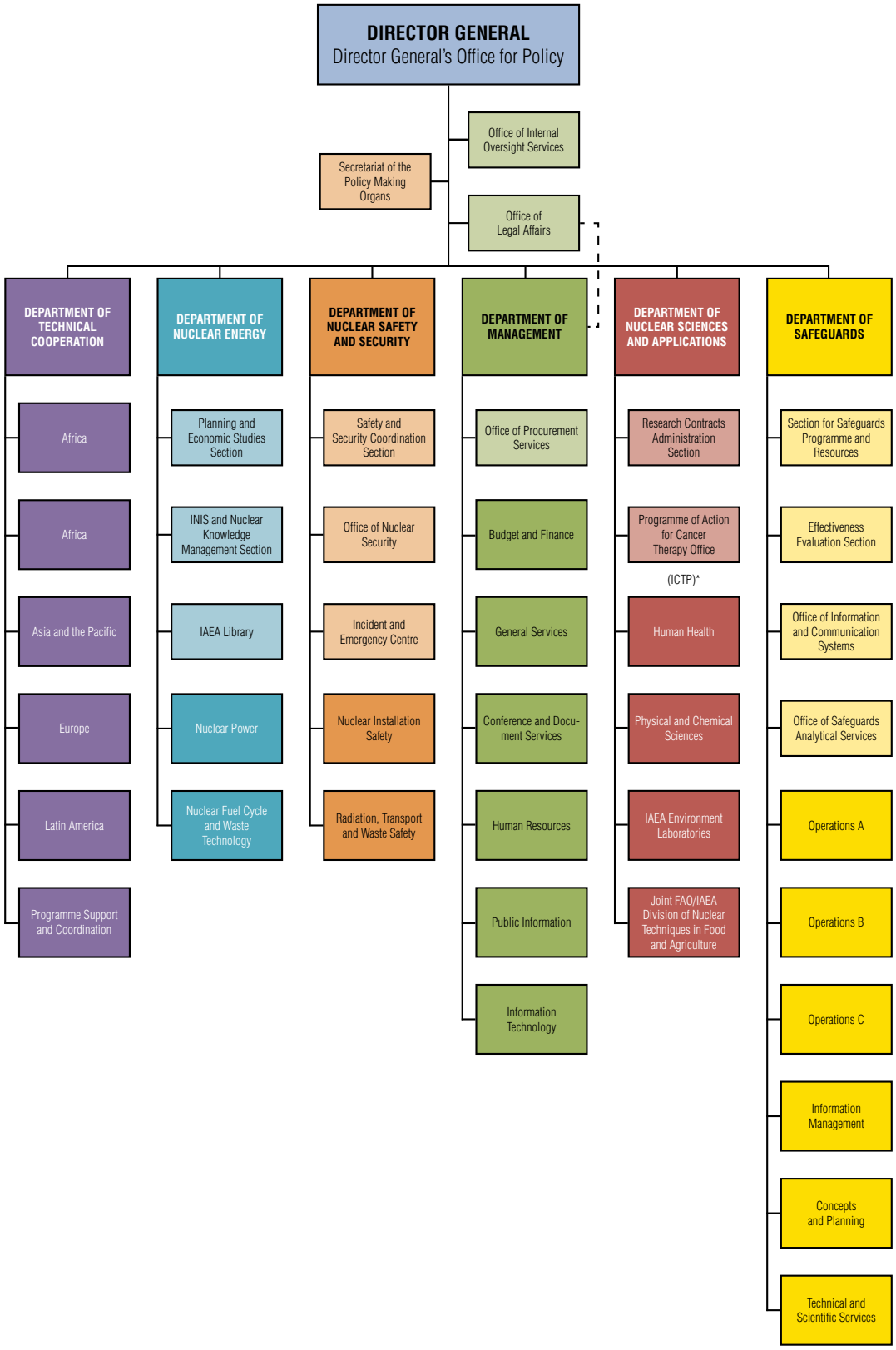
On February 17, 2012, the 41 UN Member States and Observers not also members of the Agency were as follows:

Andorra
Antigua and Barbuda
Bahamas
Barbados
Bhutan
Brunei
Cape Verde*
Comoros
Darussalam
Djibouti
Equatorial Guinea
Fiji
Gambia
Grenada
Guinea
Guinea-Bissau
Guyana
Kiribati
Korea, Democratic People's Republic of
Maldives
Micronesia, Federated States of
Nauru
Palestine
Papua New Guinea*
Rwanda*
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Samoa
San Marino
Sao Tome and Principe
Solomon Islands
Somalia
Suriname
Swaziland
Timor-Leste
Togo*
Tonga
Trinidad and Tobago
Turkmenistan
Tuvalu
Vanuatu

* For these four countries, membership has been approved by the IAEA General Conference and will take effect once the State deposits the necessary legal instruments with the IAEA.
+ The Democratic People's Republic of Korea, which joined the IAEA in 1974, withdrew its membership of the Agency on June 13, 1994.

Source: Adapted from "Member States of the IAEA," available at: www.iaea.org/About/Policy/MemberStates/ and "United Nations Member States," available at: www.un.org/en/members/.

IAEA Organizational Chart



Source: https://recruitment.iaea.org/documents/orgchart.pdf.

IAEA Chronology

Year	IAEA Event	Related Events
1946		US Atomic Energy Act Baruch Plan put to UNGA UN Disarmament Commission established
1947		UN Disarmament Commission adjourns
1949		First Soviet nuclear test
1952		First British nuclear test US detonates first H-bomb
1953	Eisenhower's Atoms for Peace speech	Soviets detonate Joe 4 H-bomb
1954		*Lucky Dragon* incident
1955	Working Group meets on IAEA draft statute Soviets express interest in joining group Geneva Safeguards Conference	First Geneva Peaceful Uses Conference
1956	Washington Conference on Statute UN Conference agrees Statute IAEA Prepcom meets	Suez Crisis Soviets invade Hungary
1957	IAEA Statute enters into force IAEA established 1st IAEA General Conference	Sputnik I launched EURATOM established
1958	Second Geneva Peaceful Uses Conference Technical Assistance Program starts	
1959	Agency convenes first scientific conferences	
1960		First French nuclear test
1961	Eklund replaces Cole as DG Seibersdorf laboratory opens INFCIRC/26 safeguards	
1962	First major symposium on nuclear reactor safety	Cuban Missile Crisis
1963	Soviet about-face on safeguards	
1964		First Chinese nuclear test
1965	INFCIRC/66 safeguards	
1968		NPT concluded
1970	Comprehensive (INFCIRC/153) Safeguards	NPT enters into force
1973	IAEA/EURATOM Agreement	

Year	IAEA Event	Related Events
1974		First Indian nuclear test London Suppliers Group (later NSG) formed
1975	SAGSI established	
1977		INFCE launched
1979		Three Mile Island accident
1980	Convention on Physical Protection concluded Committee on Assurances of Supply	Second NPT Review Conference deadlocked
1981	General Conference deplores Israeli attack Hans Blix appointed DG	Israel attacks Osirak reactor
1982	General Conference denies Israeli credentials OSARTs begin US withdraws from Agency activities	
1983	US returns to Agency (February) BOG votes to suspend South Africa (June)	
1984	China joins Agency	
1985	Geneva Group imposes ZRG on all UN agencies INSAG established	3rd NPTRC deadlocked
1986	Conventions on Early Notification & Assistance negotiated	Chernobyl nuclear accident Treaty of Pelindaba
1987		PUNE Conference flounders
1989		Berlin Wall falls
1991	Iraq Action Team deployed Strengthened safeguards program launched	Iraq invades Kuwait South Africa joins NPT Gulf War ceasefire with Iraq requires disarmament
1992	North Korean non-compliance detected	
1993	BOG approves 93+2 Verification of South African disarmament	South Africa reveals it had nuclear weapons A.Q. Khan network revealed
1994	North Korea leaves IAEA IAEA resumes inspections in North Korea under Agreed Framework Verification activities begin in Libya Convention on Nuclear Safety negotiated	DPRK threatens to withdraw from NPT Agreed Framework negotiated
1995	South Africa resumes BoG seat Illicit Trafficking Database set up	NPT extended indefinitely

Year	IAEA Event	Related Events
1997	Joint Convention on Spent Fuel & Radioactive Waste negotiated Additional Protocol agreed Mohamed ElBaradei appointed DG	
1998	IAEA Iraq Action Team withdraws	
1999	IAEA sets up Emergency Response Centre	Tokaimura nuclear accident in Japan
2001	IAEA sets up Satellite Imagery Analysis Unit	9/11 attacks on US
2002	DPRK expels IAEA inspectors MANNET report on IAEA AdSec established Nuclear Security Fund established	
2003	DPRK withdraws from NPT IAEA and US clash over Iraq BoG passes first resolution on Iranian non-compliance Nonaligned Movement Vienna chapter established	Iranian opposition group reveals Natanz site US fails to get UN Security Council resolution on Iraq Coalition invasion of Iraq Libya agrees to give up WMD programs
2004	One-off budgetary increase Nuclear Trade & Technology Analysis Unit formed	UN Security Council resolution 1540
2005	BoG refers Iran to UN Security Council IAEA Incident & Emergency System established CPPNM Amendment agreed IAEA and ElBaradei awarded Nobel Peace Prize	International Convention for Suppression of Nuclear Terrorism agreed
2006		North Korea detonates nuclear device
2007	International Seismic Safety Centre established 20/20 Commission	Israel bombs Syrian facility Kashiwazaki-Kariwa earthquake
2009	Amano appointed DG Modest budget increase	
2011	CNS Review Conference IAEA Ministerial Conference on Nuclear Safety Action Plan on Nuclear Safety agreed IAEA reports Iranian weaponization activities	Fukushima disaster (March) France convenes "informal" nuclear safety meeting UN SG Ban Ki-moon Convenes High-level Meeting on Nuclear Security
2012	Fukushima Ministerial Conference on Nuclear Safety (Dec.)	

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Acronyms and Abbreviations

ABACC	Argentine-Brazilian Agency for Accounting and Control
AdSec	Advisory Group on Nuclear Security
AFNWZ	African Nuclear Weapon Free Zone
AIPS	Agency-Wide Information System for Programme Support
AMERIPOL	Police Community of the Americas
AP	Additional Protocol
BoG	Board of Governors of the IAEA
CACNARE	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
CAS	Committee on Assurances of Supply
CBP	Core Best Practices
CDFV	Calendar Day in the Field for Verification
CENNA	Convention on Early Notification of a Nuclear Accident
CNS	Convention on Nuclear Safety
CNSC	Canadian Nuclear Safety Commission
CPFs	Country Programme Frameworks
CPPNM	Convention on the Physical Protection of Nuclear Material
CSA	Comprehensive Safeguards Agreement
CSS	Commission on Safety Standards
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CTBTO	Comprehensive Nuclear-Test-Ban Treaty Organization
CTITF	Counter-Terrorism Implementation Task Force
CWC	Chemical Weapons Convention
DBT	Design Basis Threat
DDG	Deputy Director General
DG	Director General
DIV	Design information verification
EC	European Community
ENAC	Early Notification and Technical Conventions (website)
ENATOM	Emergency Notification and Assistance Technical Operations Manual
EPREV	Emergency Preparedness Review Teams
ERNM	Emergency Response Network Manual
ES	environmental sampling
ESA	European Space Agency
ESARDA	European Safeguards Research and Development Association
EU	European Union
EU-3	European Union – Three (Germany, France, United Kingdom)
EURATOM	European Atomic Energy Commission
EXPO	External Relations and Policy (Department)
FAO	Food and Agriculture Organization (UN)
FRG	Federal Republic of Germany
FMCT	Fissionable Material Cut-Off Treaty
FMWG	Fissile Materials Working Group
GAO	Government Accounting Office (US)
GC	General Conference
GCTF	Global Counter-Terrorism Forum
GIF	Generation IV International Forum
GNEP	Global Nuclear Energy Partnership
GPS	Global Positioning System
HEU	high (or highly) enriched uranium
IACRNE	Inter-Agency Committee on Radiological and Nuclear Emergencies (UN)
IAEA	International Atomic Energy Agency
ICSANT	International Convention for the Suppression of Acts of Nuclear Terrorism
ICAO	International Civil Aviation Organization
ICNND	International Commission on Non-proliferation and Nuclear Disarmament
IEC	Incident and Emergency Centre (IAEA)
ILO	International Labour Organization
INES	International Nuclear and Radiological Event Scale
IFNEC	International Framework for Nuclear Energy Cooperation (formerly GNEP)
INFCE	International Fuel Cycle Evaluation
INFCIRC	Information Circular
INPO	Institute of Nuclear Power Operators
INMM	Institute of Nuclear Materials Management
INSAG	International Nuclear Safety Group (formerly International Nuclear Safety Advisory Group)
INSEN	International Nuclear Security Education Network
INSServ	International Nuclear Security Advisory Service
INSSP	Integrated Nuclear Security Support Plan
INTERPOL	International Police Organization
IPPAS	International Physical Protection Advisory Service
IPSAS	International Public Sector Accounting Standards
IRRS	Integrated Regulatory Review Service
IRS	International Reporting System
ISIS	IAEA Safeguards Information System
ISSC	International Seismic Safety Centre
ITE	International Team of Experts
ITDB	Illicit Trafficking Database
JCAE	Joint Committee on Atomic Energy (US)
JIU	Joint Inspection Unit (UN)
JMOX	Japan mixed oxide (Rokkasho Mura plant, Japan)
JREMPIO	Joint Radiation Emergency Management Plan of the International Organizations
LDCs	Least Developed Countries (UN)
LEU	low enriched uranium
LG-SIMS	large geometry ion mass spectrometer
LOFs	locations outside facilities
MCIF	Major Capital Investment Fund
MOX	mixed oxide
MSSP	Member State Support Program
MW	megawatt
MW(th)	megawatt (thermal)
NAM	Non-Aligned Movement
NCACG	National Competent Authorities' Coordinating Group
NEA	Nuclear Energy Agency (OECD)
NEF	Nuclear Energy Futures
NGSI	Next Generation Safeguards Initiative
NISA	Nuclear and Industrial Safety Agency (Japan)
NLO	National Liaison Officers

NNWS	Non-Nuclear Weapon State
NPT	Nuclear Non-Proliferation Treaty
NRC	Nuclear Regulatory Commission
NSF	Nuclear Security Fund
NSS	Nuclear Security Series
NSSCs	Nuclear Security Support Centres
NSG	Nuclear Suppliers Group
NTI	Nuclear Threat Initiative
NTM	National Technical Means
NWS	nuclear weapon state
OECD	Organisation for Economic Co-operation and Development
OIOS	Office of Internal Oversight
OMB	Office of Management and Budget
OPCW	Organisation for the Prohibition of Chemical Weapons
OSART	Operational Safety Review Teams
OTA	Office of Technological Assessment (US Congress)
PNE	peaceful nuclear explosion
POC	Point of Contact
Prepcom	Preparatory Committee (of the CTBTO)
PROSPER	Peer Review of the effectiveness of the Operational Safety Performance Experience Review
PSR	Periodic Safety Reviews
PUI	Peaceful Uses Initiative
P5	permanent five (members of the UN Security Council)
R&D	research and development
RANET	Response Assistance Network
RBM	Results-Based Management
REPLIE	Response Plan for Incidents and Emergencies
RSAC	Regional System of Accounting and Control
SAGSI	Standing Advisory Group on Safeguards Implementation
SAL	Safeguards Analytical Laboratory
SCART	Safety Culture Assessment Review Team
SER	State Evaluation Report
SIR	Safeguards Implementation Report
SSAC	State System of Accountancy and Control
SQ	significant quantity
SQPs	Small Quantities Protocol
TC	Technical Cooperation
TCF	Technical Cooperation Fund
TTA	(Nuclear) Trade and Technology Analysis Unit
UAR	United Arab Republic
UN	United Nations
UNCTAD	UN Conference on Trade and Development
UNDP	UN Development Programme
UNDAF	UN Development Assistance Frameworks
UNEP	UN Environment Programme
UNESCO	UN Educational, Scientific and Cultural Organization
USIE	Unified System for Information Exchange in Incidents and Emergencies
VERTIC	Verification Research, Training and Information Centre
WAES	wide (or wider) area environmental sampling
WANO	World Association of Nuclear Operators
WHO	World Health Organization
WINS	World Institute for Nuclear Security
WMD	weapons of mass destruction
WMO	World Meteorological Organization
WNA	World Nuclear Association
ZRG	zero real growth

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