

Compliance and the Non-proliferation Treaty: Developments in Safeguards and Supply Controls

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Since the official uncovering of the Iraqi nuclear weapons programme, undertaken in defiance of its obligations under the Non-Proliferation Treaty (NPT), there have been significant efforts to strengthen the non-proliferation regime, including the NPT. This paper will review some developments in the areas of International Atomic Energy Agency (IAEA) safeguards under the NPT and supply control efforts centred in the Nuclear Suppliers Group (NSG). While the NSG is not formally connected to the NPT, it has an impact on the operation of the IAEA's safeguards under the Treaty which cannot be ignored. Three broad areas will be reviewed: the nature of IAEA safeguards; information; and efforts to block or hinder equipment and material acquisitions. Issues involving nuclear smuggling will not be addressed here, although these are the object of developing international co-operation as well.

I. THE TECHNOLOGICAL AND POLITICAL CONTEXT OF COMPLIANCE

Compliance issues may be presented simply in a scientific-technical and legal-technical context, focusing on mechanisms for monitoring and verifying state behaviour and for enforcing compliance with obligations if the need arises. This may lead to the basic tech-

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nological and political underpinnings of compliance in the nuclear realm being ignored. Both sets of factors have long pointed to the fundamental dependence of compliance not on enforcement but rather on voluntary compliance and on efforts to deter or harass acquisition efforts rather than to reverse them through violent 'counter-proliferation'. In the Iraqi case, only the political-military circumstances of the Gulf War permitted the very strong enforcement measures taken against it. In the North Korean case, the costs and risks of enforcement measures gave all parties pause. In the case of South Africa, however, the cooperation of South African authorities helped to resolve issues stemming from the revelation of that state's nuclear weapons programme.

Although nuclear weapons are still very difficult to produce in technological terms, the Iraqi and North Korean cases in particular suggest that they must be considered as maturing industrial products.² New suppliers of nuclear goods and services have appeared over the years, and the ability to develop indigenous production of at least some relevant items has also spread. The adaptability of dual-use or general-purpose equipment to weapons production purposes has been noted. States are developing a capacity to begin weapons production programmes through indigenous production and through acquisitions at one or more removes from the production stream itself, thus obtaining 'the means of producing the means of production'. All of this puts increased strain on non-proliferation mechanisms premised on the basic scarcity and the demanding character of the technology.³ Political motives for refraining from acquisition efforts, voluntary compliance, and efforts to deter or harass acquisition efforts well short of full weapons production thus become of increased importance.

Any compliance system, whether for nuclear non-proliferation or income tax, is likely to depend on the voluntary observation of obligations by most of the relevant actors. Only this permits non-compliers to be isolated and managed by more vigorous methods at a reasonable cost. Voluntary compliance also permits the gathering of information which might otherwise be unobtainable; this has been a feature of anti-encryption and other aspects in Soviet-American arms control agreements, for example. The threat of detection and the prospect of deterrence which might follow⁴ have an important direct effect on potential non-compliers, and produce the necessary assurance for others, but, as Krass has pointed out, a verification system which succeeded in regularly finding evidence of non-

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2. James F. Keeley, 'Weapons of Mass Destruction as Mature Technologies', in David Mutimer (ed.), *Control But Verify: Verification and the New Non-Proliferation Agenda* (Toronto: Centre for International and Strategic Studies, York University, 1994), pp. 171-179.
 3. James F. Keeley, 'Non-Proliferation and Verification Response Strategies in a Maturing Technology Environment', in David Mutimer (ed.), *Moving Beyond Supplier Controls in a Mature Technology Environment* (Toronto: Centre for International and Strategic Studies, York University, 1995), pp. 11-29.
 4. The deterrent effect of the threat of detection actually arises in two ways: first, through the possible enforcement consequences, and second through the added expense, difficulty and delay created by additional efforts to thwart or circumvent the detection system and so avoid those consequences.

compliance would still be a political failure.⁵ True success consists of there being no non-compliance to discover.

In the case of the NPT, the fundamentally voluntary nature of compliance has produced clear, broad and significant constraints on the compliance mechanisms.⁶ Most states have neither the capability nor the intention of producing nuclear weapons, and many who have the capability do not have the intention, at least under current world political circumstances. These states may seek to receive and to give satisfactory assurances about their nuclear activities, but not at any price. They also seek continued access to the benefits of nuclear energy, and to keep the burden of safeguards at a tolerable level. They want a safeguards system which is non-discriminatory, between nuclear-weapon and non-nuclear weapon states to the extent possible⁷ and in the sense that it does not rely on invidious political judgements in the usual allocation of its attentions and resources. As against this general set of actors are those more on the margin – potential or actual proliferators. These will require more vigorous and intrusive measures of monitoring, verification and enforcement. But a system aimed primarily at these 'marginal' cases must be both adequate to its task and acceptable to the general run of states. The challenge facing the modern nuclear non-proliferation regime is to meet these two sets of conditions, in circumstances exacerbated by technological maturation and the spread of technological capabilities on the one hand and clear resource constraints on the IAEA on the other.

II. THREE LINES OF RESPONSE: SAFEGUARDS, INFORMATION AND ACQUISITION

Three lines of response to the new demands on nuclear non-proliferation will be noted briefly here: efforts to strengthen and to reorient IAEA safeguards, efforts to improve the acquisition and use of information, and efforts to block or hinder the acquisition of nuclear-relevant production capabilities. Within the IAEA, efforts to strengthen its NPT safeguards have been centred on the '93+2' programme, although some measures were taken immediately after the Iraqi revelations.⁸ These efforts focus on increased information and

5. Allan S. Krass, *Verification: How Much Is Enough?* (London: Taylor and Francis, 1985), p. 231.

6. James F. Keeley, 'The IAEA and the Iraqi challenge: roots and responses', *International Journal*, Vol. 49, No. 1 (Winter 1993–1994), pp. 126–155.

7. Under the NPT, non-nuclear-weapon states accept full-scope safeguards, but nuclear-weapon states do not have that obligation. In practice, to ease at least symbolically the resulting 'inequality of misery', nuclear-weapon states have agreed with the IAEA to put at least some civilian facilities under safeguards. This may also give the IAEA experience in some safeguarding situations.

8. The primary source used here for the '93+2' programme is IAEA, *GC(39)/17*, 22 August, 1995. For an earlier brief description, see Bruno Pellaud and Richard D. Hooper, 'IAEA safeguards in the 1990s: Building from Experience', *IAEA Bulletin*, Vol. 37, No. 1 (March 1995), pp. 14–20.

better information management, on strengthened inspection access, and on the use of environmental sampling techniques. Another group of measures is aimed primarily at optimizing the efficient use of existing safeguards methods, reflecting cost-effectiveness pressures on the Agency. One clear trade-off which some states might hope for is that strengthened safeguards could also reduce the financial and other burdens of safeguards on them. Within the realm of nuclear supply, the Nuclear Suppliers Group⁹ has broadened its membership, expanded its lists of items, and attempted to strengthen its informal co-ordination machinery. It supports the IAEA safeguards in that it now requires full-scope safeguards as a condition for new supply agreements. Its acquisition-blocking and information-exchange possibilities also support IAEA efforts, though more indirectly.

III. THE CHANGING NATURE OF SAFEGUARDS

The IAEA developed the INFCIRC/153 system of safeguards for the NPT. This was directed above all at the detection of diversions of declared nuclear material to unknown or to prohibited purposes, using materials accounting as its basic technique.¹⁰ The system allowed for design verification visits, ad hoc inspections and special inspections, with the last two in particular having the potential to deal with undeclared activities and nuclear materials, but in practice the greatest stress was on the routine inspection of declared facilities and materials. Whether or not it had the legal authority under INFCIRC/153 to ensure that declarations of nuclear materials were in fact complete, the IAEA did not

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9. Although there are considerable overlaps in membership and in the item lists between the NSG and the Zangger Committee group within the NPT system, the latter, strictly speaking, only governs exports by NPT parties to non-nuclear-weapon states under Art. III.2 of the treaty. For a brief examination of the Zangger Committee, see Fritz W. Schmidt, 'The Zangger Committee: Its History and Role', *The Nonproliferation Review*, Vol. 2, No. 1 (Fall 1994), pp. 38-44.
 10. For background on Agency safeguards, see, e.g., David Fischer and Paul Szasz, *Safeguarding the Atom: A Critical Appraisal* (London: Taylor and Francis, 1985), and Lawrence Scheinman, *The International Atomic Energy Agency and World Nuclear Order* (Washington, DC: Resources for the Future, 1987). More detailed and technical information on the INFCIRC/153 system is available in the following IAEA publications: INFCIRC/153, *The Structure and Content of Agreements Between the International Atomic Energy Agency and States Required in Connection With the Treaty on the Non-Proliferation of Nuclear Weapons*; IAEA/SG/INF/1 (Rev.1), *IAEA Safeguards: Glossary* (Vienna: IAEA, 1987); IAEA/SG/INF/2, *IAEA Safeguards: Guidelines for States' Systems of Accounting for and Control of Nuclear Materials* (Vienna: IAEA, 1980); IAEA/SG/INF/3, *IAEA Safeguards: An Introduction* (Vienna: IAEA, 1981); IAEA/SG/INF/4, *IAEA Safeguards: Aims, Limitations, Achievements* (Vienna: IAEA, 1984); IAEA/SG/INF/5, *IAEA Safeguards: Safeguards Techniques and Equipment* (Vienna: IAEA, 1984); IAEA/SG/INF/6, *IAEA Safeguards: Implementation at Nuclear Fuel Cycle Facilities* (Vienna: IAEA, 1985).

pursue this task, leaving it essentially up to national monitoring systems.¹¹ This produced a recognized vulnerability to clandestine production streams unconnected with safeguarded materials and facilities.¹² It was this vulnerability that Iraq exploited.

The Agency is now shifting its focus to some degree, to include verifying the completeness of declarations. Its primary focus will still be on safeguarding declared materials against diversion – whatever else it should do, this it must be able to do. The question of undeclared activities, however, is leading it to develop new information and access measures, and to turn to environmental sampling as a significant technology. As a consequence, while materials accounting and the quantitative focus of judgements associated with it will continue as a main Agency safeguarding technique, more qualitative methods will take on an increased importance as compared to the past.

The implications of the information aspects of the IAEA strategy will be considered in more detail below. For the moment, we may note that it is seeking further information on both locations and more general state capabilities. The location information will include not only facilities where nuclear material might be present but also those related to nuclear activities, such as training and research and development centres. Related to this, the Agency wants a right to inspect all locations declared to it. It would not necessarily exploit these expanded access rights on a routine basis, but the combination of an expanded list of facilities and a right of inspection would open up far more of a state's nuclear-related activities to the Agency. A state seeking to construct a clandestine production stream would then have to operate more completely outside its overt nuclear-related facilities.

How far beyond the flow of nuclear material the Agency should seek rights is a matter of contention. If it goes well beyond the nuclear in general, on the argument that even non-nuclear but weapons-related facilities and activities should be open to it,¹³ the Agency will be transformed, ceasing to be mainly a safeguarder and guarantor of peaceful nuclear activities and becoming more of an arms control agency. Fulfilling this radically changed

11. E.g., Ben Sanders, 'IAEA safeguards: a short historical background', in David Fischer et al., *A New Nuclear Triad: The Non-Proliferation of Nuclear Weapons, International Verification and the International Atomic Energy Agency*, PPNN Study Three (Southampton: Mountbatten Centre for International Studies, University of Southampton, for the Programme for Promoting Nuclear Non-Proliferation, September 1992), p. 10; 'Paying tribute to 25 years of safeguards leadership', *IAEA Bulletin*, Vol. 36, No. 3 (September 1994), p. 14; Lawrence Scheinman, 'Strengthened IAEA Safeguards and Special Inspections', in Tariq Rauf (ed.), *Preparing for the 1995 Non-Proliferation Treaty Extension Conference: Proceedings of International Workshops on Treaty Extension, Strengthened Safeguards, and Regional Non-Proliferation Strategies*, Issue Brief 15 (Ottawa: Canadian Centre for Global Security, January 1994), pp. 47–48.

12. E.g., Fischer and Szasz, p. 36.

13. George Bunn and Roland M. Timerbaev, *Nuclear Verification under the NPT: What Should It Cover – How Far May It Go?* PPNN Study Five (Southampton: Mountbatten Centre for International Studies, University of Southampton, for the Programme for Promoting Nuclear Non-Proliferation, April 1994) argues the case for an extended application.

role would require new resources of a scale and kind foreign to the IAEA, and new skills and activities. It is unclear that such a mandate would be acceptable in the view of many states.

Within its more traditional scope, the IAEA is also seeking expanded access beyond strategic locations in its routine inspections. These have been restricted in the past to designated areas linked to the striking of materials balances, in order to limit their intrusiveness. At present, only ad hoc and special inspections, and design verification visits, can go beyond these locations. A more vigorous use of ad hoc and design verification rights could be a significant deterrent to undeclared but co-located activities, and expanded routine inspection access rights would greatly strengthen this.

The adoption of environmental sampling is a substantial shift in Agency approaches. This method promises to be a very powerful means of checking for undeclared activities at a site, and thus to be of use at both declared sites and new sites.¹⁴ The Agency claims the right to use this technique wherever it has inspection rights. Current interest is in relatively short-range means, although some classic methods (air and water sampling) can detect nuclear activities at very long distances. As with expanded access, the use of environmental sampling could greatly complicate undeclared co-located activities. Depending on the situation and the analytical method used, it might detect not only the presence or absence of an activity but also greater detail, including the nature of industrial processes used. It can also be used to reveal past as well as present activity, and thus may complicate concealment efforts. Because much information about this method is still restricted, a full public assessment of its limits as well as its possibilities is not available. Adoption of this method will, however, be fairly costly, at a time when the Agency is under budgetary pressure.

In both its information strategy and its use of environmental sampling, the IAEA will be departing substantially from the orientation of materials accounting, which has dominated its safeguards methods to date. The attractions of materials accounting are in part its ability to limit inspection intrusiveness and its scientific and quantitative character. The former increases its acceptability, while the latter seems to reduce the scope for qualitative and 'subjective' judgements about non-compliance. Its defect is the limited scope of its applicability: it can track declared material, and can probably detect significant inflows and outflows involving a declared flow of nuclear material in many circumstances,¹⁵ but it cannot cope with fully clandestine flows. The Iraqi case perversely points out both the limits and the strengths of this safeguarding approach: Iraq only produced a few grams of plutonium, well below Agency detection standards, but the existence of a massive, well-funded, clandestine long-term weapons production complex was missed entirely.

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14. Office of Technology Assessment, US Congress, *Environmental Monitoring for Nuclear Safeguards*, OTA-BP-ISS-168 (Washington, DC: US Government Printing Office, September 1995).
 15. Bulk facilities and liquid streams present considerable difficulties, given measurement and scientific uncertainties.

Another problem arises from reliance on materials accounting. The distribution of the Agency's safeguards efforts has long seemed out of step with perceptions of the distribution of the political risk of nuclear proliferation. Large-scale nuclear activities may present the greatest risk for diversion and the greatest concentration of nuclear technology which could be turned to weapons use, and so properly are and will continue to be the major focus of IAEA attention. However, especially under developing technological conditions, the size of a nuclear-industrial sector is no longer a dominant consideration in judging proliferation danger. Verification methods driven overwhelmingly by a materials accounting approach are unable to address this problem in a satisfactory manner: materials accounting must be very sensitive to sizes of flows. The quantitative assurances which it can provide, within limits, may be welcome, but materials accounting cannot meet the new demand for assurances of the completeness as well as the accuracy of state declarations.

Turning to issues beyond the Agency's previous diversion focus will reduce emphasis on materials flows, although these will still be of great importance, and will increase emphasis on other indicators of activity. For those who find comfort in numbers, the non-numerical aspects of these additional indicators will be troubling: the scope for 'subjective' and thus possibly politicized judgements will seem greatly expanded. However, while the dangers are real, the limits of a perhaps excessively numerical approach have also been clearly exposed: it is too easy to confuse that which can and must be included in a credible safeguards system with that which can be numbered. The Agency is shifting to give somewhat greater weight to appropriate, disciplined and reasoned qualitative judgements, which need not be 'merely subjective' though they will often be non-quantitative in character.

The final set of proposals under '93+2' focuses primarily on making more efficient use of the existing safeguards system, but has implications extending beyond this. Some of the elements here are directed at using advanced technology, such as remote monitoring and remote transmission of data, to reduce the need for inspections. Other steps address inspector designation and visa issues which have long prevented the IAEA from making the most efficient use of its personnel. Improved cooperation with State Systems of Accounting and Control could reduce Agency costs. The Agency's 'New Partnership Agreement' with EURATOM promises substantial savings along these lines.¹⁶

Other possibilities in this group touch on the redefinition of Agency technical parameters. These can cut two ways, however. On the one hand is a concern that the Agency's technical parameters, specifically its significant quantity figures,¹⁷ may be too large. There is some pressure to reduce these, which will make significant new technical and scientific demands on the Agency's materials accounting capability.¹⁸ Given new demands on Agency

16. Sven Thorstensen and Kaluba Chitumbo, 'Safeguards in the European Union: The New Partnership Approach', *IAEA Bulletin*, Vol. 37, No. 1 (March 1995), pp. 25-28.

17. A significant quantity is the amount of nuclear material the Agency uses in setting its detection goals. The figure varies from kilograms to tonnes, depending on the nature of the material. One significant quantity would be the amount needed to produce one explosive device.

18. E.g., Thomas B. Cochrane and Christopher E. Paine, *The Amount of Plutonium and Highly-Enriched Uranium Needed for Pure Fission Nuclear Weapons* (New York: Natural Resources Defense Council, Inc., 13 April 1995).

resources and constraints on those resources, one might ask whether this focus would be the most marginally cost-effective response at this time.

On the other hand is the hope that, in some states, the inspection burden could be reduced if the Agency could be assured that clandestine facilities did not exist. For example, spent fuel, with potentially weapon-usable plutonium, would be much less worrisome if there were credible assurances that no clandestine reprocessing capability existed within a state. Increased transparency and openness, through improved information and inspection access when necessary, might allow an actual reduction in inspections. This could help to address the problem of the allocation of the Agency's resources as opposed to the perceived distribution of proliferation risk.¹⁹ This hope is dependent on the ability of the '93+2' programme, however implemented, to provide the necessary assurances. If the programme is equal to the task technically, itself a major question, states may thus be torn between their desire to reduce safeguards costs on the one hand and the requirement for a greater IAEA ability to monitor their activities and to intrude as necessary to provide such assurances, on the other.

Some significant implementation issues arise from the legal nature of the '93+2' proposals. Some of the measures fall within the IAEA's existing authority under the NPT's INFCIRC/153 system and are being implemented now, but others require new authority. Existing authority covers some expanded information on nuclear activities and environmental sampling. Even implementation only within this set would significantly strengthen safeguards. Additional locations and expanded access for routine inspections require additional authority. Consultations on these matters have been ongoing since early 1996, but the final shape of the resulting programme is not yet clear. An effort to draft a protocol to implement these additional measures has begun, but has not yet concluded.²⁰

One may point, however, to several process-related issues regardless of the particular substantive outcome. First, the negotiation of the additional protocol will require careful wording, not only to reduce variation in obligations from one state to another, but also to avoid a more general erosion of the rights sought by the Agency. One might anticipate pressures to restrict Agency rights in detail in particular agreements and to seek 'lowest common denominators' across agreements as each state tries to avoid accepting more than the next. This was the pattern in the supplementary agreements and facility attachments under the INFCIRC/153 system.

Second, the additional protocols will probably not be brought into play for all relevant states simultaneously: for a while there may be two systems under the NPT. If there is some variation among agreements as well, there could be a ragged implementation of the protocol both across states and over time. Coordination among major NPT signatories, and some nudging by the NSG, might reduce the transition period. If there are attractive

19. See, e.g., David B. Sinden and John G. McManus, 'A New Safeguards Approach', in Rauf (ed.), pp. 31-40.

20. 'International Newsbriefs: IAEA Board of Governors meetings', *IAEA Bulletin*, Vol. 38, No. 3 (September 1996), p. 49.

features in the new system as compared to the INFCIRC/153 system, this will also help. The possibility of a trade-off of inspection burdens for the ability to provide stronger assurances against undeclared activities may be one attraction.

Third, some states might claim 'discrimination' in the application of the new system. This could arise in the shift from a flow and facility orientation to one in which the entire character of a state's nuclear activities, with a qualitative as well as a quantitative component, plays a stronger role in determining the Agency's interest in a given state. The allocation of effort under the new system must be defensible on technical grounds. This will mean explaining that unlike contexts and combinations must affect how like specific facilities and specific activities are treated.

Finally, the new system will apply only to NPT parties, and thus will omit some states of major concern. Only a change of policy in these states, however much helped along by external persuasion, can alter this: it is not an issue for the safeguards system as such. If the strengthened system works as hoped, it will at least address the problem of non-compliance within the NPT. This may even make the Treaty more attractive to non-parties who would otherwise be reluctant to trust IAEA safeguards under circumstances in which the costs of being wrong could be unacceptable.

IV. INFORMATION

Information is a major focus of the IAEA's '93+2' programme, as well as a major point of intersection between the Agency and individual states. It is also a point of considerable difficulty, as well as one at which a shift towards a more qualitative judgement is occurring.

Under the INFCIRC/153 system, the Agency adopted a very limited approach to information. Not only was it restricted to the 'minimum necessary' information needed to carry out its tasks, but also it treated that information with strict confidentiality. Possibly relevant information from its non-safeguarding activities was not brought to bear on its safeguards task. In post-Gulf-War operations in Iraq, the confidentiality requirement may have significantly hindered its cooperation with national intelligence agencies more used to trading information, since it made the Agency an information sink rather than an information source. Before the North Korean case, it did not receive information from other states about a party subject to verification, aside from some reports on exports. As appropriate for its materials accounting focus, it relied most extensively on voluntary reports from and on inventory verification activities within a safeguarded state. Coupled with an emphasis on computerized records, this may have led as well to a downplaying of inspectors' impressions and debriefings as an information source.

Under '93+2,' the Agency is taking a much stronger and more vigorous approach to the use of information. This is found in both the expanded information sought by the Agency from safeguarded states and seemingly innocuous references to improvements in information analysis. It is seeking more information on state activities and nuclear-relevant locations. It will make use of 'open literature', expanded state reporting on exports and imports, and other information received from outside parties. Efforts to train inspectors in observational skills and to incorporate their debriefings more systematically are

linked to this expanded information strategy. Information from the verified state and from safeguards inspection reports (including the results of environmental sampling) will still be of primary importance. However, the strategy will greatly increase the ability of the Agency to check both this voluntary information for internal consistency and for consistency against outside information – information uncontrolled by the state subject to verification. 'Proliferation pathway analysis' is the key analytical tool for this analysis.²¹

This line of response will push non-complying states into concealing their operations by beginning these outside an expanded set of activities actually or potentially known to the Agency. Efforts to develop clandestine production streams may then have to begin at some remove from that stream, and depend on facilities that are not declared to or known by the Agency. All of this will have to be kept hidden from other actors as well. Clandestine non-compliance will be made more complicated, which may have an enhanced deterrent effect.

A number of problems will arise in this strategy, however.

The Agency will gain greater leverage over undeclared activities co-located with declared activities through the safeguards measures already noted, and will gain increased leverage over both these and other, separate, undeclared activities through its information strategy, but it is likely still to depend primarily on national capabilities for the detection of the latter. Issues of bias and credibility are of obvious concern if the Agency depends on outside information. At the same time, states supplying such information may have justifiable reservations about endangering sources and methods through alerting the Agency and will wish to press the Agency strongly to act on the basis of the data they provide even if it is not completely convincing.

Additional concerns arise in that the records of these other parties in the Iraqi and the South African cases are not entirely reassuring. Commercial and other objectives compete with non-proliferation objectives, and information management problems within and between state agencies as well as among states and between states and the IAEA must be handled more effectively. And, of course, they face the efforts by proliferators to conceal their activities.²² These factors allowed Iraq, by following careful acquisition policies, to behave as a single buyer facing a set of uncoordinated sellers. Better information sharing among states could reduce this fragmentation problem to some degree and at least complicate the efforts of non-compliers reliant on imports to develop nuclear weapons production facilities. Technical limits on information-gathering, however, would still remain.

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21. For a description of the information analysis system, see Mark H. Killinger, 'Improving IAEA Safeguards through Enhanced Information Analysis', *The Nonproliferation Review*, Vol. 3, No. 1 (Fall 1995), pp. 43–48.
 22. On Iraqi methods, see e.g. David A. Kay, 'Deception and Denial Practices of WMD Proliferators: Iraq and Beyond', *Washington Quarterly*, Vol. 18, No. 1 (Winter 1995), pp. 85–105. For a discussion of the Iraqi case and of German export control measures, see Harald Müller et al., 'From Black Sheep to White Angel? The New German Export Control Policy', *PRIF Reports No. 32* (Frankfurt: Peace Research Institute Frankfurt, January 1994).

Increased information presents a management problem for the Agency as well, with both technical and political implications. Much of this information will be ambiguous even when placed into larger patterns. Dual-use and general-purpose items will complicate this, as will beginning acquisition activities at further removes from the direct production stream. Requests for clarification, touchy under the best of circumstances, will need a persuasive and reasoned basis. States will have to be patient and cooperative with the Agency if it intends to press vigorously for clarifications based on expanded information. Difficulties in obtaining clarifications as such, more so persuasive clarifications, cannot be taken as *ipso facto* proof of non-compliance, even if in some cases suspicions are further aroused by the target state.

V. ACQUISITION

A combination of the IAEA's '93+2' programme and efforts by nuclear suppliers could significantly hinder acquisition efforts by would-be proliferators. On the IAEA's part, the information, analysis and inspection provisions are key. On the part of the NSG in particular, strengthened item lists and better coordination are central.

The maturation of nuclear technology and the spread of technological capability reduce the effectiveness of supply control strategies. Smuggling, disguised acquisition, exploitation of public knowledge, dual-use and general-purpose equipment, the use of indigenously-produced items, and the ability to break down requirements into more innocuous components which might be acquired separately and then assembled, are all techniques for defeating export controls and inter-state coordination. A state with significant nuclear activities and producing well within its technological envelope would be particularly difficult to block, though it might still suffer some hindrance. States more dependent on imports could be correspondingly hindered even more.²³ The end result might be merely to drive their efforts further into the shadows and their starting-points further from a direct production stream, but this could still be very beneficial. The cost, the difficulty and the duration of a clandestine effort might be increased significantly, discouraging all but the most determined states with a reasonable technological grounding and a strong financial capability.

The '93+2' programme contributes to this result through its improved ability to identify and clarify inconsistencies, and through the combination of environmental sampling, better use of inspectors' observations and expanded inspection access. This combination will push undeclared activities away from known sites unless these activities leave no distinguishable traces. Consistency analysis of expanded information could also complicate the development of separate, undeclared sites. However, even with good cooperation from states exporting nuclear-relevant goods and services or able to acquire additional

23. Joel Ullom, 'Enriched Uranium versus Plutonium: Proliferant Preferences in the Choice of Fissile Material', *The Nonproliferation Review*, Vol. 2, No. 1 (Fall 1994), p. 13.

information through their own monitoring capability, the IAEA is unlikely to gain as much leverage on undeclared sites as on co-located but undeclared activities. For undeclared sites, the non-proliferation effort will still depend especially on the ability of states to detect and then to hinder the necessary activities.

The NSG has taken some steps to strengthen its ability to hinder acquisition efforts as a consequence of the Iraqi programme.²⁴ The steady expansion of NSG membership over the years has helped to counter the threat from so-called 'second-tier suppliers'. Meeting in 1992, the NSG added nuclear-related dual-use materials, equipment and technology to its set of controlled items, besides revising its nuclear list.²⁵ The nuclear list now corresponds to the IAEA's voluntary export reporting system.

These enhanced measures include a requirement for full-scope safeguards at least for new supply agreements as well as listing other factors which should be taken into account in export licensing. These include the status of the recipient state as a member of the NPT or of regional nuclear non-proliferation agreements, but also a judgement as to the appropriateness of the items requested for a stated use and for the user, and a judgement as to the proliferation trustworthiness of the end-user. The conditions beyond NPT adherence or the equivalent obviously intrude into sensitive areas of political judgement which would not be suitable for the IAEA. Not only would they be difficult for recipient states to accept but they could also occasion disagreement among suppliers. So long as most suppliers adhere to the guidelines and agree on these judgements, however, recipients may have little alternative but to accept their application.

The state of coordination among suppliers within the NSG is thus a crucial issue. The guidelines on nuclear exports provide for consultations among suppliers 'as each deems appropriate'. The dual-use list guidelines, however, were accompanied by a Memorandum of Understanding which provided for a more developed consultative mechanism.²⁶ This includes consultations on information exchanges, export licensing procedures, and decisions on transfers. Participating states agree to inform each other of decisions not to grant transfer requests, and not to authorize transfers of items which were refused by others without consultation. However, they are not forbidden to allow such transfers following consultation, and it appears that information on other authorized transfers, or on proposed transfers, might be shared only on a voluntary basis. There are, therefore, still potentially significant exploitable gaps in the NSG system with respect to both information and action to block exports.

A particular feature of the NSG system is that it is not a binding international agreement among the subscribers but rather a means of coordinating national policies. It has

24. A brief overview of the NSG is found in Tadeusz Strulak, 'The Nuclear Suppliers Group', *The Nonproliferation Review*, Vol. 1, No. 1 (Fall 1993), pp. 2-10.

25. IAEA, *INFCIRC/254/Rev.1/Parts 1 and 2, Communications Received From Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology*, July 1992.

26. The text may be found in *International Legal Materials*, Vol. 31, No. 5, September 1992, pp. 1097-1099.

been presented, in part for political reasons, as a set of unilateral policy statements communicated to other states through the IAEA. This is to avoid or at least to reduce the appearance of a suppliers' cartel. Nonetheless, nuclear recipients have been wary of NSG activities, leading to calls for increased transparency in its operations.²⁷

The consultation mechanism may help to resolve some coordination problems, but the NSG lacks formal compliance mechanisms applicable to the suppliers, as opposed to recipients of nuclear goods and services. Aside from informal pressures and a shared sense of the importance of supply controls for non-proliferation, there is no specific means of monitoring supplier activities, assessing the adequacy of their export control systems and harmonizing these to prevent leakage at the weakest points, or of binding them not to alter these formally unilateral policies. Finding more formal means of achieving these objectives could strengthen the non-proliferation regime substantially, but would also considerably limit the freedom of action of individual nuclear suppliers and could make participation in such a formalized group less attractive. It is not clear that member states would accept a more restrictive, legally binding arrangement. The current essentially voluntary and unilateral character of the system generates disagreement over the activities of individual suppliers, opens up possibilities for exploitation by well-informed proliferators, and offers a target for disgruntled recipients who seek more predicability and some external check over supplier states. How it could be strengthened in a manner both effective and consistent with its present character is an area for further thought.

VI. CONCLUSION

Nuclear proliferation is not quite like the weather: people not only talk about it, they also try to do something about it. Efforts to maintain and to strengthen the nuclear non-proliferation regime are subject, however, to ongoing pressures which could erode it seriously over time unless they are counterbalanced. Scientific uncertainty affects materials accounting within its sphere of application, the declared flow of nuclear material. Dual-use materials and equipment and the ambiguity of information affect the usefulness of monitoring systems even without the deliberate deception and circumvention efforts of proliferating states. Considerable political constraints affect the willingness of states to accept the financial burdens and the political intrusion of efforts to meet the problem, whether they are recipients of nuclear goods and services or suppliers.

Within the scientific context of safeguards systems, the limits of monitoring, and the political constraints which any non-proliferation regime must meet, the challenge facing the nuclear non-proliferation regime is to devise methods which significantly hinder a handful of proliferators, yet which are also acceptable to states which have no particular

27. Harald Müller, 'National and International Export Control Systems and Supplier States' Commitments under the NPT', *Programme for Promoting Nuclear Non-Proliferation: Issue Review No 8* (September 1996).

interest themselves in nuclear weapons. The initial, narrowly applied IAEA INFCIRC/153 system of safeguards under the NPT may have admirably suited the interests of non-proliferating states in general, but was clearly unable to meet the challenge of states able to circumvent its narrow scope of application. The Agency's proposals to strengthen its safeguards mark a significant shift of attention away from the classic problem of the diversion of declared nuclear materials, towards verifying the completeness of such declarations and discouraging undeclared activities. Even if only within the scope permitted it under the legal authority of INFCIRC/153, the Agency's information-gathering and analysis possibilities and its resort to environmental sampling, if pressed vigorously, could strengthen its capabilities significantly. Measures going beyond INFCIRC/153's legal authority could enhance this effectiveness still further, but how willing states are to accept these proposals is as yet uncertain.

Better coordination between the IAEA and supplier states, and among supplier states, would also have substantial payoffs. There are limits, however, imposed by the ability of states to detect proliferator activities through their national monitoring systems, their willingness to share information with the IAEA, their willingness to coordinate with each other, the inherent ambiguities and political differences which will accumulate as suspected proliferators shift their acquisition activities farther from the direct nuclear production stream, and the character of the NSG as a voluntary system of coordinated unilateral policy declarations.

There are substantial possibilities in the responses of states and of the IAEA after the Gulf War for the significant strengthening of the nuclear non-proliferation regime. It will never be able to provide ironclad guarantees, but current and proposed measures could greatly increase the detection and the deterrent effects of the current verification and compliance system. However, there are still very important problems, both technical and political, to be overcome in developing and in effectively implementing proposed measures.