Chapter 5

Verification, On-Site Inspection and "93+2"

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This is a preliminary examination of the International Atomic Energy Agency's "93+2" programme to strengthen its safeguards under the Nuclear Non-Proliferation Treaty – the INFCIRC/153 system. Efforts to improve that system took on a new impetus with the uncovering of Iraq's clandestine nuclear weapons programme. Attention has been directed to the problem not merely of safeguarding declared nuclear activities but also of ensuring that all activities which should be subject to safeguards are in fact declared and safeguarded. The particular focus of this chapter will be on the role of on-site inspection, and the possibilities for strengthening that role through the exploitation of synergies among verification technologies.

The first part of the chapter will note some general functions, characteristics and associated problems of verification. It will then briefly look at the roles of inspection as a verification technique; and finally it will consider the interactions of on-site inspection with other verification techniques. On this basis, the second part will then describe the IAEA's "93+2" programme and offer some tentative characterizations of it.

Verification, On-Site Inspection and the Interaction of Verification Techniques

Verification as a Process: Functions, Characteristics and Problems

"Verification" will be taken here as referring to the process of establishing compliance with obligations.[1] A number of more specific functions may be served by this, such as: (a) detection of non-compliance; (b) deterring non-compliance through the threat of discovery and counter-measures; (c) deterring non-compliance by increasing the cost and difficulty of avoiding detection,

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1. This draws very generally on the definition offered in Canada, *Verification in All Its Aspects: A Comprehensive Study on Arms Control and Disarmament Verification Pursuant to UNGA Resolution 40/152 (o)* (April 1986), 15-16.

and/or reducing the utility of any weapons produced; (d) providing persuasive means for the demonstration of compliance; (e) providing means to handle and resolve minor violations, ambiguities or difficulties in compliance issues; and (f) providing a means to help assess the overall functioning of a system of obligations.[2] While detection is understandably emphasized, it basically serves an instrumental function in relation to the others. A system that does not detect non-compliance will be a failure, but one that only detected violations would also fail in the larger purposes of an agreement.[3] A verification system works best when, as a result of its existence, there genuinely is nothing for it to detect.

A verification system may be treated as a process, which depends on the adequate performance of a series of steps.[4] The earlier steps set the broad shape of and the parameters for the performance of the later steps. These steps are: (a) specifying the obligations to be verified; (b) operationalizing these by specifying the information required to verify them; (c) developing and deploying the means to collect this information; (d) collecting the information; (e) developing and applying standards, guidelines and routines for the interpretation and evaluation of the data, to identify significant anomalies and uncertainties; (f) pursuing and resolving significant anomalies and uncertainties; and (g) reaching a formal conclusion regarding compliance. A sophisticated system may also include a self-assessment and innovation step.

Some generic problems are also associated with this list, and a potential non-complier may take advantage of these.[5] Just as the earlier steps have a pervasive influence on the verification system, so, too, will their associated problems. These are the following.

"Tunnel vision" may occur in the specification or the operationalization of obligations. Both were factors in the Iraqi case. The IAEA did not verify the full range of obligations under the NPT, concentrating on declared nuclear materials. As Chauvistre notes, this approach is more suited to a system of item-specific end-use controls than for a comprehensive verification system.[6]

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2. E.g., *ibid.*, 16–17; Lawrence Scheinman and Myron Kratzer, *INF and IAEA: A Comparative Analysis of Verification Strategy* (Los Alamos: Los Alamos National Laboratory, July 1992, Report LA-12350), 9–11; SIPRI, *Strategic Disarmament, Verification and National Security* (London: Taylor and Francis, 1977), 33–37; William F. Rowell, *Arms Control Verification: A Guide to Policy Issues for the 1980s* (Cambridge, Mass.: Ballinger, 1986), 15–16.

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

4. E.g., *ibid*, 7–10; Frederic S. Feer, "The Verification Problem: What It Is and What Could Be Done About It," *Journal of Strategic Studies* 8:2 (June 1985), 145–162; Bruce D. Berkowitz and Allan E. Goodman, *Strategic Intelligence for American National Security* (Princeton: Princeton University Press, 1989), 30–42.

5. See Berkowitz and Goodman, 185–192, for a detailed illustration of some possible failures.

It reflects the origins of the Agency's safeguards, and also reminds one of the U.S.-Soviet debate over "controlling disarmament" versus "controlling arms."[7] As well, national intelligence systems overlooked the possibility that Iraq might use obsolete technologies, such as uranium enrichment through electromagnetic isotope separation.

A "dead flies" problem could develop if relevant information fails to register on the system even if it is available. (The label is taken from the suggestion that a frog will starve in a box of dead flies: it identifies as food only flies which move.) A verification system may "look at" something but fail to recognize its significance. Milhollin has noted, for example, that IAEA inspectors are not trained to recognize nuclear weapons components.[8] Other possibilities are that an inspector may see something but is either afraid to report it or the safeguards system is not capable of accepting or using the information. Excessive dedication to the standardized performance of inspection routines could also produce this effect.

There may be other data collection and analysis limits. These may be in financial or personnel resources, technical limits of scientific measurements, or political and legal limits such as the lack of a mandate. There may be information fragmentation or mismanagement. The relevant data being collected may be scattered among a number of groups within a verification agency, or across a number of agencies. Since "one person's signal may be another's noise," data may not reach the user for whom it is most significant.

Then there are problems of interpretation and evaluation. People tend to see what they are trained to see. Information may be of uncertain credibility, ambiguous, blurred, or improperly assembled. A violator may attempt to deceive a verification system by trying to hide its true actions and presenting misleading actions.

There may be difficulties in following up anomalies and uncertainties. A system should not flood the upper, more political levels of the verification agency with trivia, but it must ensure that significant cases are identified and moved upward for further examination and possible resolution. The actions taken to reduce the risk of overlooking violations increase the risk of false alarms. Finally, where anomalies and uncertainties point to an apparent case of non-compliance, there may be political obstruction or a reluctance to trigger the ramifications of making a formal finding to that effect.

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6. Eric Chauvistre, "The Future of Nuclear Inspections," *Arms Control Today* 14:2 (August 1993), 27–28, 29–30.
7. That the matter is not yet fully resolved is evident in IAEA, *GC(39)/17, Annex 3*, an excerpt from the 860th Board of Governors Meeting, which discusses the "93+2" programme.
8. Gary Milhollin, "The new arms race: the Iraqi bomb," *The New Yorker* (1 February 1993), 51.

A system which performs well in the later steps of the process, being reasonably competent within its scope, will contribute to compliance by blocking or hindering some non-compliance possibilities. IAEA safeguards over declared nuclear materials and associated activities discourage the misuse of these. A determined violator wishing to avoid detection by the safeguards must then exploit broader, more pervasive weaknesses in the earlier stages of the process. This may mean higher costs and other difficulties. Iraq is such a case, with additional activities to confuse and disguise its efforts to develop and operate a fully clandestine nuclear weapons production stream.[9] Iraqi use of declared activities to reduce the marginal cost of "going nuclear" was discouraged, but the failure of the IAEA to ensure both the correctness and the completeness of state declarations allowed Iraq to develop extensive undeclared activities. The Agency's "93+2" programme for strengthening its safeguards responds in part (resource limits have also played a role) to demands that it deal more effectively with the threat from undeclared activities.

On-Site Inspections

On-site inspection is probably the most psychologically- and politically-satisfying verification technique, and also one of the most sensitive. The ability to go where other verification techniques cannot, and see what they cannot, is its general strength. While some authors strongly favour it, however, others think it is significantly limited.[10] The arguments of this latter group are of particular interest here.

On-site inspections may be categorized a number of ways: continual, periodic, random, quota, challenge, etc. For our purposes, the functions they serve within a verification system are crucial. Four of these are: (a) the routine inspection of declared items; (b) closing, shut-down, destruction or conversion inspections; (c) baseline inspections; and (d) pursuit inspections.[11]

Routine on-site inspections occur at declared facilities or sites, and concern declared activities or items. They try to discourage the misuse of these, or the

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9. See, David A. Kay, "Iraqi Inspections: Lessons Learned," *Eye on Supply* 8 (Winter 1993), 88–98, and "Denial and Deception Practices of WMD Proliferators: Iraq and Beyond," *The Washington Quarterly* 18:1 (Winter 1995), 85–105.

10. This discussion draws particularly on: James A. Schear, "Cooperative Measures of Verification: How Necessary? How Effective?" *Verification and Arms Control*, William C. Potter, ed. (Lexington, Mass.: Lexington Books, 1985), 7–35; Sidney N. Graybeal and Michael Krepon, "On-Site Inspections," *Verification and Compliance: A Problem-Solving Approach*, Michael Krepon and Mary Umberger, eds. (Cambridge, Mass.: Ballinger, 1988), 92–108; Lewis A. Dunn (with Amy E. Gordon), "Striking a Balance: Toward an On-Site Inspection Strategy," *Arms Control Verification and the New Role of On-Site Inspection*, Lewis A. Dunn and Amy E. Gordon, eds. (Lexington: Lexington Books, 1990), 139–157; Rowell, 59–65; Krass, 212–223, 254–255.

11. The term "pursuit" is used here because others – challenge, special, demand, etc. – are given particular meanings within individual verification systems.

diversion of items or materials to unknown or prohibited uses. A strong routine verification system will thus deny a covert violator the use, or at least the significant and easy use, of these declared facilities, items or materials. This has been the main point of emphasis of IAEA inspections under INFCIRC/153, leaving other types (e.g., ad hoc and special inspections) less developed.[12] Closing, shut-down, conversion or elimination inspections also deal directly with declared facilities, items or activities. Their point is to ensure that facilities or items are actually destroyed, that activities at a location have ceased, that facilities are not operating or that, having been converted to other uses, are being operated for only those other uses.

Baseline inspections establish, verify and update the initial inventory of items or facilities subject to verification. They may also provide detailed site characterizations to help in planning other inspections. An inadequate system for the establishment, characterization and updating of an inventory will weaken the comprehensiveness of routine and closing inspections.[13] The inability to establish a baseline effectively limits verification to declared items, to an item-specific system, and so could limit or even undermine the possibilities for agreements among states.

Pursuit inspections arise from a suspicion of non-compliance. Such suspicions could develop: (a) if routine or baseline inspections at or other information concerning a facility suggested that it was being misused (*in-situ* pursuit); (b) if there was evidence of undeclared items entering a facility or of items within the facility being diverted to outside locations (boundary pursuit); or (c) where there was concern that declarations of relevant activities, items, or facilities were incomplete (baseline pursuit). These functions and inspection types interact along the lines suggested in **Diagram 1**.

Given the establishment and updating of a baseline inventory, baseline inspections prepare for other inspections. They could also suggest possibilities for baseline, boundary or *in-situ* pursuit inspections. Closing inspections confirm the removal of items from the inventory for further routine inspections. They could also lead to boundary and *in-situ* pursuit inspections. Routine inspections could suggest undeclared on-site activities or point to

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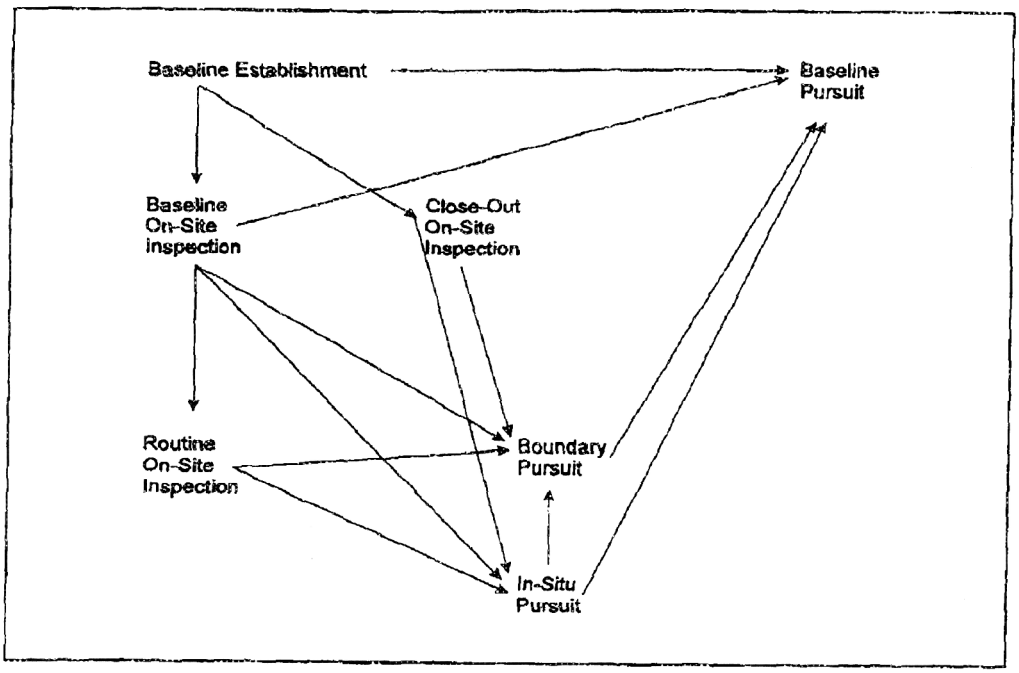
12. Lawrence Scheinman, "Strengthened IAEA Safeguards and Special Inspections," *Preparing for the 1995 Non-Proliferation Treaty Extension Conference: Proceedings of International Workshops on Treaty Extension, Strengthened Safeguards, and Regional Non-Proliferation Strategies*, Tariq Rauf, ed., Issue Brief 15 (Ottawa: Canadian Centre for Global Security, January 1994), 47–48; Ben Sanders, "IAEA Safeguards: a short historical background," *A New Nuclear Triad: The Non-Proliferation of Nuclear Weapons, International Verification and the International Atomic Energy Agency*, David Fischer *et al.*, eds., PPNN Study 3 (Southampton: Mountbatten Centre for International Studies, University of Southampton, for the Programme for Promoting Nuclear Non-Proliferation, 1992), 10; "Paying tribute to 25 years of safeguards leadership," *IAEA Bulletin* 36:3 (September 1994), 14.

13. Graybeal and Krepon, 99.

Diagram 1: The Interaction of Inspection Types



activities crossing facility boundaries, giving rise to *in-situ* or boundary pursuits. Evidence of *in-situ* violations could also point to boundary and to baseline pursuits if the undeclared on-site activity makes no sense without further, undeclared activities at unknown sites. Boundary pursuits may point to undeclared sites, and thus to baseline pursuits. Given this network of relationships, not only poor verification for any one type but also poor follow-up as the types shift will seriously restrict on-site inspection and thus its value as a verification technique.

The value of routine and closing inspections is recognized, and the roles for these are clearest. The importance of a sound baseline inventory system is also acknowledged, but the ability to ensure one is more problematic. It is the value of baseline pursuit inspections above all that is most seriously questioned. Pursuit inspections at declared sites may confirm or disconfirm suspicions of undeclared activities on-site or at unknown sites, but if the latter is the case, how can on-site inspections go beyond this?

Four particular difficulties are often suggested in dealing with undeclared sites: (a) the site must first be detected and located; (b) an inspection at an undeclared site is unlikely to be permitted if it will find anything; (c) an inspection which finds nothing is at best only an uncertain reassurance; and (d) such inspections could be abused.

For the first problem, it may be argued that the "real" work is done in detecting and locating the site. (Even if inspectors could freely rove around a territory looking for suspicious activities – a right neither cost-effective nor politically acceptable – one might wish to differentiate between this initial search activity and the actual examination of a specific site.) The evidence needed to justify an on-site inspection, especially if other parties must be convinced to grant the request, would have to be quite damning in its own right, it is suggested. The actual inspection would then be only a final, dramatic *coup de grace,* which might not even be necessary. While this might be true in some cases, however, it need not be true in all.

The second objection suggests that a state might refuse access because there really is something to hide, although there could also be valid reasons for a refusal. However, the act of refusing a seemingly legitimate and credible request will feed suspicion, not reduce it. A covert violator may avoid giving positive proof of non-compliance, but at the cost of hardening suspicion which may make its deception activities more difficult. Both objections may miss a crucial function of baseline pursuit inspections. The threat of inspection is important, as well as the actuality. Trying to avoid a request for a baseline pursuit inspection may drive non-compliers to more costly, more difficult, more indirect and less satisfactory efforts, which may itself be a discouraging factor. If evasion efforts themselves generate recognizable patterns observable by other techniques, a non-complier may be forced into a catch-22 situation.[14]

The third objection notes the weak status of a negative finding of an on-site inspection. This, strictly speaking, clears the site, not the suspect state. However, some mechanism must be available to a suspect state seeking to establish or re-establish its bona fides. If ambiguous results arise from poor inspection routines or lack of timeliness, the answer is to make improvements in these areas. Inherent technical limits pose other problems, but multiple methods may be used to try to cope. Moreover, the fact that "not proven" is not the same as "not guilty" may still have some value.

Fear of abuse arises in two forms. First, there may be valid reasons to refuse inspections, which could be frivolous or harassing, or concern legitimately sensitive sites. Requiring a third party to make or assess inspection requests, or to conduct the inspections, could give some protection as compared to a system of direct bilateral challenge inspections. In the IAEA's case, an inspection request comes from the Director General, not from another state. He does not have to go initially to the Board of Governors, but will need sufficient evidence to defend the request before the Board if necessary, e.g., if the request is refused and he then seeks a formal statement that the Agency cannot

14. Dunn and Gordon, 236–237.

assure compliance. The Agency has suggested a possibility of "managed access" for legitimately sensitive sites.

The second form of abuse is that a state in non-compliance may deliberately provoke an inspection at a clean site, hoping thereby to give a false reassurance or at least to tarnish suspicions.[15] It would take a fine judgement to carry out such a ruse, however. Evidence of undeclared activities need not point to any specific site: detection is not location. It may be easier to mislead detection than to point specifically to a site both initially sufficiently suspicious yet "clean" on closer examination, without this all being suspicious in its own right. The UNSCOM experience in Iraq might be educational in this regard.

The Interaction of On-Site Inspection and Other Verification Techniques

McFate *et al.* have pointed out the possibility of exploiting synergies – mutually reinforcing connections – among verification techniques to strengthen non-proliferation.[16] Their interactive approach points to the use of multiple information-gathering techniques. For our purposes, the information sources of interest are: (a) national technical means; (b) national intelligence means; (c) routine reports from other parties to an agreements; (d) open literature; (e) aerial or near-site monitoring; (f) reports from verified states, and (g) on-site inspection and in-house analysis by a verification agency. These may be further condensed into three broad categories: (a) "transparency" information provided voluntarily by the state subject to verification; (b) information resulting from activities – inspection and in-house analysis – by a verifying agency; and (c) information supplied from additional, "independent" sources.[17] The nature of a verification agency and its activities will be reflected in part in its position relative to these three categories, as in **Diagram 2**.[18]

"Transparency" information, of itself, can only be checked for internal consistency. If it can be cross-checked as well with other information, includ-

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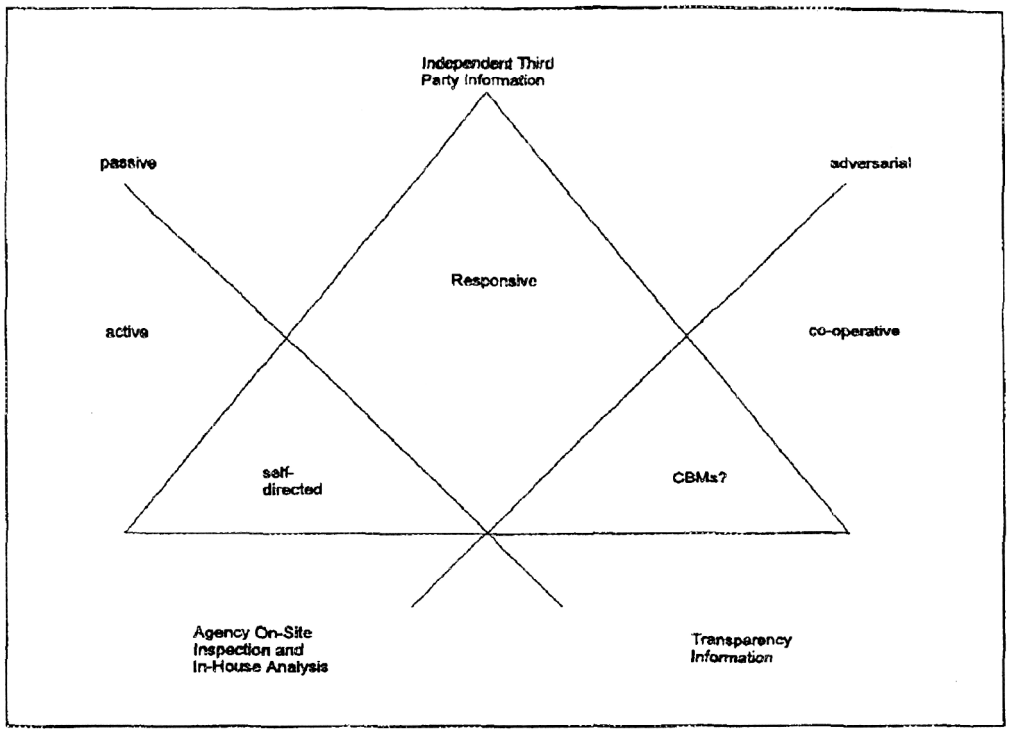
15. Graybeal and Krepon, 101.

16. Patricia Bliss McFate *et al.*, "Constraining Proliferation: The Contribution of Verification Synergies," *Arms Control Verification Studies*, No. 5 (Ottawa: Non-Proliferation, Disarmament and Arms Control Division, Department of External Affairs and International Trade, March 1993).

17. Aerial and near-site monitoring could be performed by either the verifying agency or a third party.

18. Two basic preconceptions about verification may create problems in assessing the IAEA. The first is the demand for absolute assurance of compliance, which is not possible to obtain. The best one may get is a reasonably high-confidence assurance. How much confidence is enough, however, will vary with the perceived risks and costs of being wrong. Second is the assumption that verification must be primarily adversarial and must be based on information independent of the verified state. This overlooks the potential uses of "transparency" information, which may supply data not readily available otherwise. Since the IAEA departs substantially from these two positions, taking them as a starting-point creates an innate tendency to doubt its verification effectiveness.

Diagram 2: Relations Among Information Source Types and the Character of a Verification Agency



ing from on-site inspections, it can become a very useful basis for verification. If we adopt Ek's analogy – that "transparency" is like a glass house while "openness" (i.e., access for inspection) is like access to a brick house[19] – "openness" and "transparency" are more than merely complements, much less alternatives.[20] "Openness" is one guarantee that the house really is glass. Information from other sources, subject to confirmation and analysis, strengthens that guarantee. These other information sources deprive the verified state of full control over the relevant information, and thus reduce its leverage on the framing of interpretations and evaluations based on that information.

On a more detailed level, we may see three groups of potential synergies according to function with respect to on-site inspections: (a) techniques that augment on-site inspections; (b) techniques that help in preparing for on-site inspection; and (c) techniques which detect and locate sites for possible inspection.

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19. Paul Ek, "SAGSI Approaches to Strengthened IAEA Safeguards," in Rauf, ed., 71.
20. Kratzer views them as complements. Myron B. Kratzer, *International Nuclear Safeguards: Promise and Performance*, Occasional Paper Series (Washington, D.C.: Atlantic Council of the United States, April 1994), 17.

Techniques that augment on-site inspections may be directed particularly to reducing the intrusiveness and the labour intensity of routine inspections, assisting in measuring or checking the characteristics of safeguarded items, and so on. They could include materials accounting, specific sensing and measuring devices, seals, containment and surveillance equipment, etc. These techniques may make inspection more precise, more acceptable, and more scientific, but they also carry a price beyond dollars. They will play a role in the definition, performance and measurement of the inspection task itself. This may get to the point of reducing the inspector to the servant of these technologies, a robot-inspector checking off boxes, carrying out highly-determined routines, and maintaining the on-site monitoring equipment. Along with strict interpretations of the inspectors' rights and tasks, they could contribute significantly to a "dead flies" problem and to a passive inspectorate. The "proper" performance of inspections could become a ritual valued in its own right apart from any actual contribution it might make to effective verification.

A second group of techniques could assist in preparing for inspections. This would include the assembly and analysis of relevant information about the site or facility to be inspected and the operations known or thought to be going on there, how safeguards (if any) have been applied there in the past, and briefings on the inspection routine. A subset of this group could form a set of "layered" technologies for site mapping and control. One could begin with satellite imagery for initial site mapping, and then aerial means to control perimeters prior to an inspection. Other methods might check for emissions. Aerial methods could also be used to monitor a complex site during inspections, to try to ensure that a "shell game" or other observable means were not used to try to defeat the inspection.

The third group deals with detecting and locating a site for inspection. This is probably the most difficult task, especially if plausible justification must be given for a request for an on-site inspection. Finding evidence that an undeclared site may exist is not the same as locating a possible site. *In-situ* and boundary transgressions at known sites, disappearance of equipment or material, wide-area environmental sampling, etc., may only suggest that there is something, somewhere. The Iraqis showed the limits of satellite surveillance, just as they have shown how other detection techniques may be challenged.[21] A "layering" approach to site detection and location may not serve, if more distant techniques are also less sensitive and if these layers act to filter out sites, removing them from further analysis on this basis. Non-complying states might play to this in their detection efforts. Thus, detection and location efforts will have to be open to combinations of information from different sources at all times, exploiting all the possibilities of synergies among information sources. Use a net to catch a fish (detection and location); use a chain

21. See footnote 9.

to haul it in (layering and other preparation); use a fine and skilful knife to fillet it (on-site inspections).

The Agency's "93+2" Programme[22]

Description

The IAEA developed its "93+2" programme to strengthen its safeguards in light of Iraq, and to respond to resource limitations. Effectiveness and cost-effectiveness are driving concerns. **Table 1** presents a summary of the programme's proposals, organized by the Secretariat's consideration of whether or not they fall within the Agency's current authority or would require additional rights.

Those falling within its current authority, the so-called "Part 1" measures, have been approved by the Board of Governors and are now in the implementation stage. The "Part 2" measures will require further consultations and definition before their actual content and the means of their implementation are settled. What happens in and to "Part 2" will determine the nature of the Agency's NPT safeguards.

The measures fall into three categories: (a) greater access to information; (b) greater access to locations for inspection; and (c) optimal use of the current system. Aside from Part 1/Part 2 relations, there are a number of other cross-cutting connections. First, while the "optimal use" measures reflect a cost-effectiveness orientation, the inspector designation and visa measures are also linked to access issues, especially for no-notice inspections. Second, the combination of greater access to locations and no-notice inspections could lead to cost-effectiveness results in their own right. They could also be the basis for a radical shift in the allocation of the Agency's safeguards and inspection effort, a departure from the model of INFCIRC/153. Third, the expanded declarations are backed in part by the expanded right of access to locations, though the Agency might not exercise its physical access right regularly. Fourth, the Agency argues that it has a right to use environmental sampling on-site, or at least at strategic points, under current comprehensive safeguards agreements. But this sampling is not cheap. If, as the Agency claims, the "93+2" programme is cost-neutral, these costs will have to be made up elsewhere. If much of the cost recovery comes in "Part 2," how that phase is implemented will be particularly important. Fifth, if "Part 2" measures are carried out along the suggested lines, the Agency's focus will shift from simply locations with nuclear material to include locations with nuclear-related activities, or even other locations, even if no nuclear material is there. This could increase both information needs and costs.

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22. This description and analysis are based particularly on: IAEA, *GC(39)/17*, 22 August 1995; Bruno Pellaud and Richard D. Hooper, "IAEA safeguards in the 1990s: Building from experience," *IAEA Bulletin* 37:1 (March 1985), 14–20; and on interviews in Vienna, 13–15 November 1995.

Table 1: A Summary of the Legal Evaluation of Measures Proposed for Strengthened and More Cost-Effective Safeguards[1]

			Measures within existing legal authority	Measures requiring complementary authority
BROAD ACCESS TO INFORMATION	Expanded Declaration	1. Information on the SSAC	x	
		2a. Information on past nuclear activities (to the extent necessary to enable the Agency to verify the completeness and correctness of the State's declarations) through access to existing records on production of nuclear material and on related facilities	x	
		2b. Information presently provided routinely: (i) design information and modifications thereto, including closed-down and decommissioned facilities; (ii) accounting and operating records; (iii) accounting and special reports; (iv) operational programme	x	
		2c(i). Description of the nuclear fuel cycle, and of other activities involving nuclear material	x	
		2c(ii). Description of nuclear fuel cycle-related R&D (hereinafter referred to as nuclear R&D) activities	Nuclear R&D involving nuclear material at nuclear facilities and other locations containing nuclear material (LOFs)	Nuclear R&D not involving nuclear material at nuclear facilities, at LOFs, at nuclear training institutes, at R&D centres and elsewhere
		2c(iii). Information, to be agreed with the State, on operational activities additional to that required under INFCIRC/153 (see 2b(iv) above)		x
		2c(iv). Nature of each of the buildings on the sites on which are located nuclear facilities, LOFs or nuclear R&D activities	In limited cases, depending on the configuration of the facility or LOF	x
		2c(v). Nature of any other locations directly related to the operation of nuclear facilities, LOFs or nuclear R&D activities		x
		2c(vi). Location and status of known U and thorium ore deposits and mines		x

			Measures within existing legal authority	Measures requiring complementary authority
		2c(vii). Domestic manufacturers of major items of nuclear equipment or materials		x
		2c(viii). Information identified in GOV/2629 (voluntary reporting on nuclear material and specified equipment and non-nuclear material)		x
		3a. Early provision of design information	x	
		3b. Plans for the further development of the nuclear fuel cycle		x
		3c. Description of planned nuclear R&D activities		x
	Environmental Sampling[3]	For ad hoc inspections, at locations where the initial report, or inspections carried out in connection with it, indicates that nuclear material is present	x	
		For routine inspections at strategic points	x	
		For special inspections, at the locations where these take place	x	
		For design information verification, at any location to which the Agency has access to carry out design information verification	x	
	Improved Analysis of Information	Improvements in the Agency's information analysis methods	x	
INCREASED PHYSICAL ACCESS	Broad Access[3]	Access to locations beyond strategic points in nuclear facilities or LOFs, but within the sites containing such facilities or LOFs	*During design information verification at nuclear facilities and during ad hoc inspections*	*During routine inspections*
		Access to other locations identified in the Expanded Declaration		x
		Access to other locations which may be of interest to the Agency, under voluntary arrangements with the State	Comment: Arrangements of this kind have been helpful in the past. The Secretariat encourages all States to make standardized arrangements in this respect.	

			Measures within existing legal authority	Measures requiring complementary authority
	No-notice Inspections	Unannounced (no-notice) routine inspections	At strategic points	At locations beyond strategic points within the sites containing nuclear facilities or LOFs
		Unannounced (no-notice) inspections at other locations identified in the Expanded Declaration		x
OPTIMAL USE OF THE PRESENT SYSTEM	SG Technology Advances	Use of unattended equipment	x	
		Remote transmission of inspection data	x	
		Remote monitoring of safeguards equipment	x	
	Increased Co-operation with States and SSACs	The SSAC carries out activities that enable the Agency to conduct inspection activities	x	
		The Agency and the SSAC may carry out selected inspection activities jointly	x	
		The Agency and the SSAC may carry out selected support activities jointly	x	
		Use of simplified procedure for designation of inspectors		x
		Multiple-entry visa, long-term visa or visaless entry for inspectors on inspection	To permit unannounced inspections	
		Use of available systems for direct communication (including satellite systems) between inspectors and installations in the field and Headquarters	x	Where such systems are not available in the State
	SG Implementation Parameters	Significant quantities of nuclear material	x	
		Conversion/detection times	x	
		Starting point of safeguards	x	

1. Source: IAEA, GC(39)17, 22 August 1995: Annex 4, GOV/2807, 12 May 1995, 3-7.

2. The Agency may implement environmental sampling at any location to which it has access. Accordingly, environmental sampling could be used as a matter of course at locations where access has been given under complementary authority.

3. These proposals are not intended to affect the Agency's right to implement special inspections.

It is precisely because of these linkages and the uncertainty about the "Part 2" measures that the final shape of the safeguard system as a result of "93+2" cannot yet be determined. It could be simply an extension of the current INFCIRC/153 system, or it could be substantially different.

The information measures aim at expanded declarations by safeguarded states, environmental sampling and improved data analysis. The declarations would increase state transparency about on-going and planned nuclear activities, and would be backed by greater physical openness even if such inspection rights were only used infrequently. Some information could also touch on a state's export activities, an item currently covered under voluntary measures. This information flow would increase the scope for internal consistency checks, as well as checks of the declarations against outside information and the results of inspections. The Agency also hopes that its design verification rights might be used vigorously as a legal lever for inspection access.

Environmental sampling is emphasized as a particularly promising technique, though one that could also be quite expensive. The Agency claims the right to sample wherever it has access. Longer-range or wide-area monitoring, presently used in Iraq under different circumstances, may present both technical and legal problems. It may detect undeclared activities without locating them. It may depend on access to a state's territory. It may raise the legal question of whether sampling to try to locate a site, as opposed to sampling at a located site, is considered part of or a preparation for a special inspection. If the sampling is simply on-site, it would be confined to declared or located sites. A state could try to defeat such sampling by: (a) restricting undeclared activities at declared sites to those having no or innocent traces; (b) restricting such activities to those whose emissions would be compatible with, or masked or confused by, legitimate on-site activities; and (c) using the maximum possible partitioning of undeclared activities from others at the site and the maximum possible containment of those undeclared activities.

The rather innocuously-worded item, "Improvements in the Agency's information analysis methods," is given very brief treatment in the Fall 1995 documentation to the General Conference.[23] It points to one element in the Agency's response to Iraq, an assertion of its right to receive information from outside sources. This information could include open literature, routine reports from other states, "transparency" information from the safeguarded state, inspection reports, and intelligence reports from other states. The very low-key treatment of this item could indicate both a feeling that Agency rights have been established here and a recognition of the sensitivity of the issue. How this item is pursued will be of great importance, since it is on this basis that the Agency's ability to detect inconsistencies in information will largely

23. IAEA, *GC(39)/17, Annex 1: GOV/2784*, 21–23. See also: Pellaud and Hooper, 15, 18; and Mark. H. Killinger, "Improving IAEA Safeguards through Enhanced Information Analysis," *The Nonproliferation Review* 3:1 (Fall 1995), 43–48.

rest. Whether or not the Agency will pursue its information collection and analysis goals vigorously, and whether states are willing to accept this, is a key point in the development of the entire programme.

The Agency's analytical techniques will include the generation of "country profiles." Information will be organized and analysed through the use of "proliferation critical path analysis," a detailed, multi-layered construction of all possible proliferation paths. Going beyond simply finding anomalies, this analysis would be used to conduct consistency checks and to provide a basis for requests for clarifications from a safeguarded state.

Properly exploited, this could significantly hamper a non-complying state. However, it will depend on the quality of the information received and the quality of the analysis carried out. The fragmentation of relevant information among various states gave Iraq greater scope for its activities, and this measure does not directly address that problem. The problems posed by dual-use equipment, and by acquisition and production activities removed from a direct weapons production stream, still exist.[24] Information bias will have to be controlled. Analytical routines will have to be updated continuously. There also seems to be a great reliance on computer-driven decision rules. This could create a tendency to let computers do the thinking, rather than analysts.

"Increased physical access" covers both a widening of the scope of inspections to cover various activities and the use of no-notice inspections. Backing up the expanded declarations, it could lead to a larger as well as a more intrusive system of inspections. However, it could also permit a radical shift of inspection effort from the formula of INFCIRC/153, and thus a potential for system transformation.[25] INFCIRC/153 allocates inspection effort according to technical criteria which reflect facility type and throughput, material type and inventory, the nature of a state's State System of Accounting and Control (SSAC), and the general nature of a state's fuel cycle.[26] The resulting distribution is rather at odds with the current perceived distribution of proliferation risk. Greater emphasis on a state's overall nuclear programme configuration, backed by the desired information and inspection rights, could lead to a considerable redistribution of resources as well as possible cost-savings.

Improving the current safeguards system includes a substantial effort to use labour-saving devices, although this would entail some initial capital costs,

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24. See, e.g., James F. Keeley, "Non-Proliferation and Verification Response Strategies in a Maturing Technological Environment," in *Moving Beyond Supplier Controls in a Mature Technological Environment: Proceedings of the 3rd Canadian Non-Proliferation Workshop*, David Mutimer, ed. (Toronto: Centre for International and Security Studies, York University, 1995), 17–22.

25. See Ek, 69–70; J.G. McManus, "A New Safeguards Approach," in Rauf, ed., 27–30; and David B. Sinden and John G. McManus, "A New Safeguards Approach," in Rauf, ed., 31–40.

26. IAEA, *INFCIRC/153*, paras. 78–82.

and an effort to use inspectors more efficiently. Co-operation with the SSACs would try to take advantage of improvements in these to reduce the burden on the Agency. The Partnership Agreement with EURATOM is an example, though the scope for other agreements that might promise such savings could be limited.

Implementation parameters touch on the technical criteria for the design and operation of the safeguards system and for assessing its performance. These may be major factors in both the generation of high-confidence assurances and the creation of "tunnel vision" and "dead flies" problems. There is scope for both the tightening and the relaxation of these parameters, with attendant implications for resource allocation and costs. The emphasis in "93+2" on additional information suggests that these parameters, and the quantitative anomaly focus so heavily based on them, will yield to some degree to a broader focus in inconsistencies. Such a broader approach will necessarily lack the comforting apparent precision of these quantifiable parameters however, and may, therefore, give greater scope for both judgement and controversy.

Instead of a Conclusion: A Tentative Characterization of "93+2"

Because so much depends on whether and how "Part 2" of the "93+2" programme is implemented, one can only speculate as to the final shape of the Agency's NPT safeguards that will result. What is offered here, then, is a conditional and tentative assessment.

First, the Agency's past focus on declared activities and sites continues as its primary focus. There is some extension on the margin to include nuclear-related activities and undeclared activities. Undeclared activities at declared sites would be more vulnerable, especially through environmental sampling and no-notice inspections. Through these, there could be possibilities for pursuit inspections to uncover the existence of undeclared sites. However, the Agency's emphasis will continue to be the detection of boundary and *in-situ* transgressions. This will particularly be the case if the final system does not move far from "Part 1."

While the Agency recognizes the importance of undeclared sites, it clearly sees the dangers on the margin of declared activities and facilities as more central to its efforts. Strong action at declared points will drive a non-complying state to more difficult, more costly and potentially less satisfactory strategies to avoid detection. One could fairly ask, however, whether this focus is reaching the point of diminishing returns. A shift of focus more towards undeclared sites would require a considerable change in the Agency's legal as well as financial and organizational resources. This does not seem likely even within the scope of "Part 2." The Agency seems content to leave the detection and location problems presented by undeclared sites largely up to individual states to solve; it will not be the primary vehicle for these tasks.

Thus, the Agency only partially handles its "tunnel vision" problem. Barring appropriate arrangements, it may convert this into more of a "dead flies" problem. It may be able to do something if a target is pointed out to it, but it will still be less able to spot the target on its own.

Second, the Agency will normally make only limited use of verification synergies other than those arising from the technological augmentation of (particularly routine) inspections. Its analytical activities may help overcome some problems of information analysis, but this will depend as well on the willingness of states to help solve the fragmentation problem. Other synergies will depend on activity to prepare for a site inspection or to detect and locate sites. Environmental sampling is a useful augmentation for on-site inspections, but one with cost implications. It may give particular leverage against undeclared activities at known sites, but may be more useful for site inspection and possibly detection than for site location. Its use in a wide-area role presents both technical and legal problems. What might happen to it under "Part 2" is unclear.

Third, the Agency will continue to rely significantly on "transparency" information, but this will be modified by a more systematic exploitation of, and possibly access to, additional information. Greater in-house analysis will prevent the expanded use of outside information from producing movement simply towards a passive and responsive role. It is through this information collecting and analysis that the Agency will gain greater leverage on undeclared activities and sites, assuming that these do not significantly overlap with declared facilities. This is the locus for improvement in baseline establishment and updating. The additional "transparency" information of the expanded declaration depends, of course, on "Part 2." Absent this, the outside information and in-house activities of the Agency assume an even greater importance.

Fourth, certain "dead flies" problems remain, and others may be created. Potential difficulties in the information analysis sector have been noted: excessive dependence on computer-generated analysis or computer-driven decision rules. Problems arising in the conduct of inspections are not directly addressed in any strong and obvious fashion. However, efforts may be made through inspector training to develop a more aggressive and observant inspectorate. A shift from an inspection model driven primarily by quantitative parameters to one in which qualitative information plays a significant role may help. The major questions to be faced here are: (a) whether states will tolerate a less strictly-controlled inspectorate; (b) whether a more inquisitive inspectorate is the best place to intervene, rather than at more senior levels; (c) whether inspector de-briefing will play a more significant role in in-house analysis; and (d) whether efforts for a more aggressive inspection function will be institutionalized.

Fifth, the outcome of "93+2" will depend on a variety of factors, some pushing safeguards from their current character and others possibly pulling them in certain specific directions. Among "push" factors, Iraq and resource constraints are important, but these will not necessarily drive the system beyond a revision of INFCIRC/153. "Part 1" operates under the grant of authority in INFCIRC/153, and therefore cannot move beyond this. The fate of "Part 1" will thus be of particular importance. The more significant the measures taken in "Part 2," the greater the chance of large shifts occurring in the safeguards system and possibly in the role of on-site inspections within it.

A number of "pull" factors may be noted. Cost considerations could lead to a strong interest in trade-offs, particularly because of the cost of environmental sampling. They could also increase interest in a trade of wider physical access in return for changes in the frequency of routine inspections. But the degree of intrusiveness potential in the expanded declaration and the associated push for wider inspection rights might be hard for states to accept. It could contribute to an interest in focussing such inspections more narrowly. Unhappiness with the distribution of the inspection burden under INFCIRC/153 could also be a factor.

A final "pull" factor could be the prospect, if any, of a cut-off in the production of fissile material for weapons purposes. Various safeguards approaches could be applied to this, with widely varying but quite significant associated costs.[27] States may not be willing to accept the cost of INFCIRC/153-type safeguards. At the same time, applying one set of safeguards, on a lesser scale, to nuclear weapon and threshold states and another, comprehensive, set to non-nuclear weapon states under the NPT is fraught with obvious political difficulties. Although not intended for this purpose, "93+2," especially in its "Part 2" aspects, could provide an opening for greater flexibility in respect to the cut-off. It could present a possibility for the radical reform of the NPT safeguards system in conjunction with the cut-off. Conversely, failure to reach a cut-off agreement, or at least failure within the time-frame of the "93+2" programme, could remove this factor.

Finally, specifically with respect to on-site inspections, "93+2" obviously entails some changes in inspection routine and others in the scope of application, but the primary focus of the Agency will be fundamentally unchanged. The emphasis on routine inspection will only be modified somewhat, even if a shift in inspection allocation occurs. Pursuit inspections will continue to be derivative, not primary, tasks. The Agency's main efforts will still be focussed on inspections of declared activities at declared sites, not searching for undeclared activities at undeclared sites. Routine inspections may shift, however, to reflect greater use of random or no-notice inspections.

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27. See, e.g., Vilmos Cserveny, "A Cut-Off Treaty and Associated Costs," Workshop on a Cut-Off Treaty, Toronto, Canada, 17–18 January 1995.